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EDITORIALS

CO-OPERATION BETWEEN ARCHITECT AND ILLUMINATING ENGINEER.

Architecture is one of the oldest arts. Consequently it is rich in artistic traditions and uses many beautiful conventional forms that have become well established through long centuries. On the whole, its tendency is strongly conservative, in important buildings, at least. Artificial illumination is a quite modern art, however, and in the last few decades has received extraordinary impetus through the development of new illuminants of high power and efficiency. It is only during the last ten years that the principles of scientific illumination have received much study, resulting in their application through a newly developed branch of engineering.

Architects have hitherto scarcely concerned themselves with the problems of illumination, because until artificial illumination came into vogue both the exteriors and interiors of buildings were viewed almost exclusively by natural light. Even recently the artificial illumination has been given very minor consideration by the architect, whose primary concern as a rule has been the artistic effect. In fact, although he should be deeply interested in the principles of illuminating engineering, he has held himself aloof from association with the illuminating engineer, who at first could talk only in terms of efficiency and neglected reasonable efforts to harmonize his ideas with artistic or architectural requirements.

During the last few years, however, illuminating engineers have devised means and produced installations wherein the architectural features, both of interiors and exteriors, have been greatly enhanced by judiciously designed artificial lighting; indeed, very pleasing effects unforeseen by the architect have been produced. The architect is therefore becoming aroused to the possibilities of artificial illumination and is beginning to see the value of co-operation with the illuminating engineer.

A marked evidence of this wholesome tendency was shown in the paper read by Mr. C. A. Carpenter before the Chicago Section of the Illuminating Engineering Society last week, as briefly reported in this issue. Representing one of the large architectural firms in the country, Mr. Carpenter showed that in many cases it was desirable to modify the architectural design in order to secure improved illumination. This is a very notable concession on the part of the architect. It shows that by the exercise of reasonable tact by both illuminating engineer and architect it is possible to meet on a common ground and produce results which will satisfy the ideals of both. Every possible encouragement should be given to this co-operative tendency, which is capable of achievements valuable not only to the parties bringing it about but to the public in general.

ADVANTAGE OF GROUPING SMALL TOWNS ON TRANSMISSION SYSTEMS.

Usually in considering the question of whether electrical service in a small town shall be supplied by a local power plant or by a larger plant in another town over a transmission line, the decisive emphasis is placed upon a comparison of the cost of generating the electrical energy locally by means of small units with the cost of transmission combined with the lower generating costs at the distant station. In many cases the latter proves to be the most economical, but even when it is not, the question should not be decided upon this basis alone.

There are other considerations which should be given considerable weight in solving this problem, since the cost of delivering electrical energy to the local distribution system is not the only cost involved in the business. This was very pointedly brought out in the paper presented by Mr. A. Hardgrave at a meeting of electrical engineers held in Chicago this week. The centralized management of electrical service in a group of neighboring towns has all the advantages of economy in management, in purchasing supplies and securing engineering talent, etc., that have been demonstrated to be so advantageous in the case of the holding company which manages a number of electric utilities in different parts of the country. Centralized supply has, however, other advantages which even the utilities operated by such holding companies do not enjoy. Neighboring communities may have predominating loads of different types, one being distinctively residential in character, another presenting an important industrial load, while a third town may be a commercial center, the fourth a mining town, etc. Towns of such different characteristics lend themselves especially well to joint supply, since the diversity in characteristics implies at the same time diversity in time of maximum load. The advantages from the point of economy of a large diversity-factor are well appreciated, and this is one element of advantage which centralized supply holds over isolated generating stations.

The same diversity in the character of communities also adds to the security of an investment for joint supply as compared with the investment in an isolated central station for supplying electric service. The possibilities of serious loss of load, of decreasing population or actual abandonment of important industries, present a much less serious problem in the diversified territory. Consequently the financial aspect of the proposition is much more inviting.

Even with all other things being equal, the use of transmission lines for serving isolated communities has still one advantage over the local power plant and this resides in the possibility of securing business at points along the line by supplying service to farmers or intermediate communities for whom no one could think of supplying service otherwise on account of the diminutive size of the possible load to be secured. Many instances have been brought to the attention of our readers from time to time where the use of an outdoor substation connected in upon a transmission line has made it possible to serve such communities at some profit, thus adding to the total load and to the diversity of the entire system.

TWO IMPORTANT RATE CASES.

The two Massachusetts commissions charged with the regulation of public utilities are now deeply engaged in rate investigations of far-reaching significance. The Public Service Commission is in the midst of a profound inquiry into the petition of the Bay State Street Railway Company for authority to increase its fares from a five-cent to a six-cent unit, and the Gas and Electric Light Commission is getting well started in an arbitration of street-lighting rates at Boston which bids fair to become one of the most interesting cases in this field in recent years.

In the Bay State case, some ninety municipalities served by the 900 odd miles of track on the system, are now attacking the evidence of the company that it must increase its rates in order to yield a fair return to its stockholders, pay good wages to its men, and maintain standards of service demanded by the public, with all that that implies. The company's experts, at a cost of approximately $120,000, have prepared an extraordinary amount of ammunition and discharged a good share of it in the form of ten volumes of unit and total costs showing as nearly as possible the detailed outlay which the company had to make in every part of its Massachusetts system for physical plant and property, and indicating, on the basis of route apportionments, the total costs and consequent revenues necessary on all parts of these lines to put the road on a satisfactory footing.

In the Boston street-lighting case, the Edison Electric Illuminating Company has presented a monumental study of this branch of its service, based upon an analysis of the cost of installation and operation of the system required for illuminating the streets of Boston proper. A more interesting example of the application of engineering judgment to cost apportionment would be difficult to find. The company concludes that with between three and four thousand 6.6-ampere magnetite arc lamps in service, the investment per lamp exceeds $625, including all the items in the company's property which in its opinion are chargeable with a share in the cost of street illumination.

This figure, which is more than twenty times the bare cost of the lamp itself and certainly more than seven times the cost of a lamp and supporting pole, indicates how much specialized equipment is properly located behind the scenes, as it were, in street-lighting, and illustrates the difficulties the average citizen inevitably must encounter in attempting to pass judgment, as he sometimes does, upon the fairness of a given price for such service. In the Boston case the city has retained an expert electrical engineer from the Harvard University staff to look after its interests, while the company was fortunate enough to be able to draw upon its own electrical chief of staff for this work. As the hearings progress, the work of the engineers in both the Bay State and street-lighting cases is sure to be of great technical interest. It goes without saying that the findings of the two commissions probably many months hence, will be based upon a most exhaustive examination of the operations and contentions of the companies concerned, and will establish conclusions which will be of the widest interest in the public-utility field.

THE COMING CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The program for the convention of the National Electric Light Association, to be held next month in Chicago, indicates that the convention will be one of unusual interest. The program, which is given on other pages, is longer than usual, and includes sessions for the Company Sections and for the Electric Vehicle Section, the latter resulting from the affiliation of the Electric Vehicle Association of America. As usual in recent years, the activities of the Commercial Section dominate the program, and six sessions have been arranged for, including a number of novel and valuable items. Among these may be mentioned the report of the Committee on Electric Ranges, the reports of the Industrial Electric Heating and Lighting Sales Bureaus, the lecture by Mr. Durgin, and the report of the Committee on Competitive Power Sources. Altogether, 22 sessions have been scheduled, of which four are general sessions. This does not include the Public Policy session, which will be a closed meeting for Class A members only.

The central location of the convention city, combined with the attractive program of reports and papers, and the excellent arrangements which are being made, should insure a convention which, from the standpoint of both interest and attendance, will be the most successful ever held by the Association.

WINDOW DRESSING.

The indifference of many electrical contractors to the appearance of their show windows is truly astonishing. It is a sad reflection upon their merchandising ability, yet it must be reluctantly admitted that some pay absolutely no attention to this subject, and frequently the window of an electrical contractor's shop or store is the least attractive to be found upon the street. It is occasionally worse than that—even positively repellent.

What is the reason for this neglect? Evidently the contractor does not realize the benefits to himself to be derived from the best use of window displays. In some cases the electrical contractor is a contractor simply, and does not attempt to carry on a store. He does not carry a stock of appliances, and makes no effort to sell wiring material or other supplies. He therefore thinks a window display has no value for his business and will not bring any returns. This is a mistake—a failure to appreciate human motives and influences or the psychology of business. Many a new customer will be repelled by an unattractive exterior and will carry his inquiry for wiring to a more inviting door. Many a possible prospect who might be started to thinking of wiring his home or his factory by a suggestive or thought-compelling display will be inevitably lost to that particular contractor. Contractors of this class would be better off without a show window. They should be located in the rear of some building, in a basement or upper story, like a carpenter shop, or else have merely an office and not a store in which to receive visitors and transact business. They are wasting good money when they pay rent for a first floor front.

When the electrical contractor is also a dealer there is less excuse for the neglect of window dressing. Whether his trade is confined to supplies, or also includes the sale of current-consuming devices, his show window represents his greatest advertising asset. Too often he lets it become a liability, solely through neglect. Of course the dealer who simply conducts a retail business unaccompanied by contracting realizes the value of his show window and bestows some attention upon it, for if he did not show this much merchandising acumen, he would not long remain in business. But the average contractor piles as great a variety of his stock as possible into his window, postpones changing it until he has nothing else to do, and in the meanwhile lets it accumulate dust and other earmarks of neglect. Even when newly dressed the window is not attractive if it contains a great variety of miscellaneous articles. It may prove as bewildering as a Chinese puzzle, and the observer leaves without having his attention concentrated upon any one object or idea. He carries away in his mind no permanent impression from the jumble.

Two suggestions may well be considered here in connection with window dressing. One is to have a definite purpose in view every time the window is dressed, and concentrate the attention of the observer upon some particular object which is capable of arousing his interest. This has two advantages. The passer-by may be stimulated to purchase, and he will at least receive some definite impression which tends to fix in his mind the fact that there is such a proprietor doing business in such a place. That is one of the aims of advertising and this form of advertising is secured at little cost.

The other advantage of this method is that it does not exhaust the resources of the window dresser, and the next week he can make an entirely new display, featuring some other article in his stock. And similarly the week following, and the next after that. He not only has a window which will attract attention, but he can make a fresh display whenever desired.

The other suggestion is to dress the show window frequently, say once a week, so that when passers-by have discovered that there is a window in this location worth looking at, they will find a new interest at frequent intervals, and will not be wearied with a monotonous repetition whenever the eye is permitted to wander to this display. A reputation for progressiveness in this direction will carry with it the idea that the contractor is up to date in his installation methods and familiar with the latest and most approved materials of construction.

DISPOSING OF WOOD WASTE.

The question of disposing of the sawdust, shavings, scraps of wood, etc., from the various types of woodworking plants is often a serious one, and sometimes it is the deciding one when the application of central-station energy is being considered. It is brought to our attention once more by the communication from Mr. F. A. Coffin in this issue. It is undoubtedly true that a solution of the problem often depends upon bringing into contact the consumer and the producer of this wood waste, and that the alert power solicitor can often be the means of bringing this about.

In this effort the power solicitor is to have the help of the United States Government. The office of Industrial Investigations of the Forest Service has instituted a wood-waste exchange and is compiling information regarding the supply of wood waste and the demand for it. This information is made available in the form of specific quotations from *bona fide* buyers and sellers of waste who co-operate by supplying complete information regarding the exact form, species, sizes, and amounts of waste available or desired. Schedules requesting this information were sent to a number of wood-using establishments and a list has been gradually built up. It now contains the names of several hundred manufacturers. By communicating with the Forest Service, opportunities for profitably disposing of waste may be brought to light which would otherwise remain unknown.

Happenings in the Industry

American Institute Sections to Hold Joint Meeting by Aid of Telephone—Court Decides on Flaming-Arc Carbons—Tie Line Authorized in Massachusetts—Important Power Developments in Mining Districts of Tennessee—Massachusetts Commission Considers Boston Street-Lighting Contract—Miscellaneous News Notes

Long-Distance Telephony at Annual Meeting of American Institute.

On Tuesday, May 16, simultaneously with the meeting of the American Institute of Electrical Engineers in New York City, meetings of sections will be held in Boston, Philadelphia, Atlanta, Chicago and San Francisco, and all of these meetings will be connected together by long-distance telephone. Arrangements are being made to supply each one in attendance in these different cities with receivers, which will be connected to a line joining them all. A number of transmitters will be in service at each one of the meeting places, and what is said by the speakers in each of these cities will be heard by all of those in attendance at the various meetings.

The telephone facilities necessary for this remarkable feat will be supplied by courtesy of the American Telephone & Telegraph Company, of which President J. J. Carty of the American Insitute is chief engineer. While long-distance telephony has already been utilized from coast to coast and conversations heard by audiences at each end, this is said to be the first time that so many audiences have been simultaneously put into communication with each other. The necessary connections to the long-distance circuit will be made at 8:30 p. m. Eastern standard time. This will be 7:30 p. m. in Chicago and 5:30 p. m. in San Francisco. It is proposed not only to have short addresses in the various cities which may be heard by all, but to actually transact some of the business of the annual meeting by telephone communication.

New York Court Decides on Duty on Flaming-Arc Carbons.

The United States Court of Custom Appeals, New York, has handed down an important decision stipulating the duty to be imposed on flaming arc carbons, sustaining a contention of manufacturers and importers that a rate of 40 cents per 100 feet was applicable under the proper classification.

This test case, brought in the name of H. M. Hirschberg Company, is of unusual importance and interest. The action was based upon the view taken by the Collector of the Port of New York, in holding that electric-light carbons came under the recently adopted clause of "carbons for flaming-arc lamps" and exacting a duty of 30 per cent. The importers contended that an assessment of 40 cents per 100 feet should prevail in consideration of the first part of the same clause, reading: "Carbons for electric lighting composed chiefly of lampblack or terort carbon."

The Board of General Appraisers in passing upon the case held that the testimony was not sufficient to show which provision of the classification (paragraph 82) should apply, and, furthermore, that the testimony given was not convincing enough to warrant a change in the collector's decision.

In its ruling, the Court of Custom Appeals says: "The Board of General Appraisers failed to accept at its value the testimony which was adduced on behalf of the importers. The question presented was whether the latter clause in the paragraph was to replace the provision for carbons for electric lighting if composed chiefly of lampblack or retort carbon, at the specific rate of 40 cents per 100 feet, under the present law."

Massachusetts Lighting Commission Authorizes Stock Issue for Tie Line.

The Eastern Massachusetts Electric Company has been granted authority to issue 1,250 shares of stock, at $100 par, to pay part of the cost of building a transmission line to connect the plants of the Salem, Malden and Suburban lighting companies in Massachusetts. An outline of the project was published in a recent issue. The company applied for approval of $250,000, the amount of the authorized capital, but the Commission deems it expedient to postpone, until completion of the line, its approval of the balance of stock necessary for construction.

The Commission says: "The importance of the new line to the future destinies of the three plants which it will connect is manifest. Its justification must rest upon its resulting in a more efficient supply of electricity for all three of the communities served."

Some objection was voiced to a new corporation being formed to build the line, some urging that one of the existing companies should be sufficient to carry out the project. The majority of the Board holds that this is not open to discussion; but Commissioner Schaff, in a dissenting opinion, claims that the creation of this corporation is a departure from the policy of the state, in that the transmission company will be a subsidiary of a holding company, the North Boston Lighting Properties, which owns and controls the Salem, Malden and Suburban companies. It will have as its sole customers fellow subsidiaries of the North Boston Lighting Properties, and Commissioner Schaff points out the danger of absorbing the surplus profits of the other companies, which should go to writing off dead capital which it duplicates. The state provides reasonable facilities for the activities of corporations, and there seems to the Commission to be no justifiable reason for a "go-between corporation."

Dependence of Architecture on Illuminating Engineering.

At a meeting of the Chicago Section, Illuminating Engineering Society, held in the Edison Building, Chicago, on April 20, a paper on "The Relation of the Architecture of an Interior to its Illumination" was presented by C. A. Carpenter, electrical engineer of Graham, Burnham & Company, architects. The paper touched on numerous instances in which modifications of the architectural designs of interiors were made in order to secure greatly improved illumination. Among such cases cited were a long narrow concert hall, multi-sided show windows, art galleries, interior fountains, etc. The illumination should bring out the architectural features. Frequently by a slight modification of the design this may be accomplished to great advantage. Where the artificial illumination comes in a different direction from the natural illumination, weird effects are frequently produced. Co-operation and mutual tact on the part of the designer and illuminating engineer produce the best illumination results.

The paper was discussed by Morgan Brooks, E. W. Lloyd, J. R. Cravath, M. G. Lloyd, W. A. Durgin, Frank F. Fowle, Albert Scheible, J. Stair and F. H. Bernhard.

Power Developments Necessary in Mining Districts of Tennessee.

The great increase in the demand for minerals developed by the war has made the extensive mineral fields of Eastern Tennessee highly attractive and has led to a big enlargement of operations among the companies that have mines in that section. This has been accompanied by an increased power use at the mines. A number of large installations and developments are being made and a still greater amount of work along this line is being planned.

The Aluminum Company of America, which has a smelter at Maryville, Tenn., near its bauxite properties, is installing a steam plant which will add 10,000 horsepower of electrical power for mining and hoisting use. In addition the company has purchased riparian rights on the Little Tennessee River and has planned a project of a series of seven dams which will furnish 300,000-horsepower. The company has already made settlements with the railroads along this river to cover the cost of elevating their tracks above the overflow.

The American Zinc Company, of Mascot, Tenn., will purchase 5,000-horsepower additional from the Tennessee Power Company. This corporation has recently sunk a number of deep shafts and has increased its output materially. The Tennessee Power Company has also extended its transmission lines to the properties of the Tennessee Copper Company, at Copper Hill. The power for this line is taken from the No. 2 hydroelectric plant on the Ocooe River. The same power company has also contracted with the Ducktown Sulphur, Copper & Iron Company to furnish the latter with 1,500 kilowatts. The power company has started construction on the Caney Fork River which will add 1,200 to 2,400 kilowatts within the next few months and a considerably larger amount of power whenever desired and the greater part of this will be used for industrial purposes similar to those mentioned.

The Chattanooga & Tennessee Power Company is adding four new turbines at its dam at Hale's Bar to develop 20,000-kilowatts additional.

While none of the large smelters in that section are using electric furnaces of large size, the Chattanooga Steel Company, which was recently organized at Chattanooga, will install equipment of this kind.

BOSTON LIGHTING CONTRACT CONSIDERED BY COMMISSION.

Data on Cost of Street Lighting Presented by Edison Electric Illuminating Company of Boston.

The Massachusetts Gas and Electric Light Commissioners, on April 20, took up the consideration of a tentative contract between the city of Boston and the Edison Company for street lighting, made November 16, 1914, for a 10-year term. The city and company agreed jointly to request the Commission to investigate and determine whether the schedule E rates charged are fair. If, after investigation, the Commission shall find that a fair price is less than the total amounts to be paid under schedule E, one or more of the rates may be reduced by the board.

The rate for 800-candlepower magnetite 500-watt arc lamps, burning 3,828 hours per year, works out at $87.53, this being a fixed cost of $36 and a running cost of 1.6 cents per lamp hour. There are 4,543 lamps of this type, making up the principal item in street illumination.

For the 24 Thoran 500-watt direct-current arcs, the rate is $148.05 each, and for 2,910 40-candlepower and 1,157 60-candlepower incandescents, $18.33 and $21.14, respectively. These, with a few larger incandescent units, make up the total of $479,718.

The company, in a very complete tabulation of costs and apportionments, claims operating and maintenance expenses, on account of the city street service, of $284,627, leaving a gross profit for proportion of general expenses, dividends and depreciation of $195,092.

Costs of operation and maintenance are given as follows:

Production cost, delivered to the substation high-tension bus, 13,406,884 kilowatt-hours, @0.7375 cent		$98,875.77
Operating and maintaining lamps:		
Trimming arcs	$48,568.06	
Patrolling arcs	9,248.71	
Repairing arcs	12,916.22	
Incandescent lamps	36,358.39	
		$107,091.38
Operating lines and fixtures:		
Arcs	$8,568.62	
Incandescent	2,620.52	
		$11,189.14
Maintaining lines and fixtures:		
Arcs	$51,691.81	
Incandescent	7,170.46	
		$58,862.27
Stock-room expense:		
Arcs	$4,567.00	
Incandescent	2,041.50	
		$ 6,608.50
Records and billing		2,000.00
Total		$284,627.06

The Edison Company assigns 4.9 per cent of general office, lands, buildings, laboratory, records, transportation and repair equipment and general stock, to the city street lighting. Substations are apportioned to the extent of 2 to 87 per cent on account of street lighting, while proportion of the L Street generating station is so assigned, on the basis of 3,223 kilowatts, at $116. The total investment assigned to arc street lighting is $2,900,118, or $635.01 per arc lamp. Investment in series incandescent lighting is $180,860, and in multiple incandescent, $288,470.

Details of investment for arc lighting are per lamp:

	Per 6.6-amp. Arc Lamp.
General offices, land, buildings	$ 9.21
Service property	17.08
Laboratory	.92
Records, plans, agreements	1.07
Transportation and repair equipment	4.15
General stock, supplies, fuel, etc.	6.28
Arc lamps and parts, stocks	1.20
Substation lands and buildings	14.35
Generating station, L Street	81.86
Transmission lines	4.84
Switching apparatus	.78
Converting apparatus	61.29
Lamp poles	61.06
Arc lamps	27.71
Conduit for arc circuits	109.94
Cable for arc circuits (572 ft.) (No. 6 underground cable, installed, 0.2524 per foot.)	165.95
Manholes	31.54
Poles and attachments	19.59
Wire (404 ft.)	16.15

Investment in the L Street generating station is given in details as follows:

Land	$ 400,464.64
Buildings	2,059,054.02
Boilers, piping and accessories	2,055,154.51
Generating engines	164,146.00
Turbines and generators	1,548,666.83
Engine generators	127,050.57
Accessories and electrical equipment	41,551.28
Miscellaneous accessories	904,738.26
Coal handling apparatus	386,541.33
Miscellaneous equipment	36,752.87
	$7,724,120.32
Deduct value of Brush machines and equipment	154,918.00
	$7,569,202.32
Investment per kilowatt (total capacity, 105,000 kilowatts)	$ 72.00
Maximum load of entire system, 1914, 65,342 kilowatts Total investment per kilowatt of maximum load	$116.00
Maximum load, Boston arc light system, 3,181 kilowatts Per arc lamp	$ 81.86

Operating expenses per arc lamp are as follows:

Production and substation costs	$17.80
General expenses, generating stations	.77
General expenses, substations	.49
Repairing overhead lines	3.12
Repairing underground cables	4.71
Repairing underground conduit	.45
Repairing lamp poles and fixtures	3.02
Operating overhead lines	.75
Operating underground cables	.48
Operating underground conduit	.51
Rental of attachments	.14
Trimming	10.63
Patrolling	2.03
Repairing	2.84
Stock room expense	1.00
Recording and billing expense	.22
Total	$48.96

Corresponding expenses for series incandescent lamps average $12.98 per unit and for multiple lamps, $15.59.

Present Selling Policy is Chief Topic at Meeting of Electrical Jobbers.

The Central Division of the Electrical Supply Jobbers' Association held a two-day session, April 20 and 21, at Excelsior Springs, Mo., with an attendance of 50 from the leading supply houses in that district. A. J. Selzer, of Chicago, Ill., named chairman of the division at the Detroit meeting of the national association, presided. The chief topic of the meeting was that of the proper selling policy under the conditions of advancing prices of materials. There was a consensus of opinion that the present prices of finished articles, based on the cost of replacing them on the shelves, represented the full values, and probably would be much lower than prices that might prevail later if the advances in the cost of manufacture continued.

The program Thursday morning was opened by an illustrated talk by N. G. Harvey on "Selling Policy." He pointed out the rapid increase in the costs of materials during the past few months. F. M. Bernardin, talking on the same subject, gave statistics on the advances in the costs of materials and of manufacture. The subject "Supply—How It Affects a Selling Policy," was discussed by W. W. Low and H. P. Andrae, who went into even more detail than the previous speakers as to the shortage of supplies. Friday morning's session was devoted to other phases of the marketing problem. The first paper was by H. L. Grant, on "Co-operation." He discussed the need of closer co-operation among jobbers and retailers that the facts of the war situation might be more clearly and generally understood, and that a demoralization of the market and prices might be avoided, a demoralization that might seriously affect the distribution of electrical equipment and mechandise. S. E. Kennedy talked on "The Abuse of the Cash Discount."

There were expressions, in the discussions which followed the papers, and among the members, of confidence in the business outlook, which was advanced as a clinching reason for not making sacrifices of proper profits by selling goods below the cost of replacement.

The Central Station in Small Cities.

At the joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, held on the evening of Monday, April 24, the subject for discussion was the central station in cities of less than 50,000 inhabitants.

The first speaker was Albert J. Goedjen, of the Merchants' Heat and Light Company, Indianapolis, who contrasted the conditions in large and small cities, and pointed out the reasons for failure in the latter in so many instances. The local capitalists instituting such ventures are often without experience in the business, and practice is far from being standardized, various voltages, frequencies and numbers of phases being used. An example was given of replacing a small generating station by a transmission line connecting to a larger plant.

A. Hardgrave, of the Middle West Utilities Company, showed the importance of the load-factor and diversity-factor with respect to supplying small communities from a large distribution system, and pointed out how the central station in small cities is handicapped by an inexperienced staff, by low density of population, low load-factor, small revenue per customer, and the necessity for keeping the investment low. Conditions are improved by grouping towns on transmission systems.

Adam Gschwindt, of the Rockford Electric Company, described the requisite qualifications for a good manager, which include judgment, diplomacy, mental bravery, etc. The aim of the manager should be to give perfect service.

R. L. Fitzgerald, city manager of Winnetka, Ill., pointed out the duties and qualifications of a city manager, which largely involve engineering matters. The papers were discussed by Messrs. Hatch, King and Junkersfeld.

Mr. Junkersfeld also told of the work of the Industrial Preparedness Committee, which has been organized by the Naval Consulting Board, and Mr. Grant presented the Octave Chanute medal in mechanical engineering to H. E. Goldberg.

Dallas Utility Election to be Contested.

As acting head of the city, the mayor of Dallas, Tex., has been officially notified that the recent election, at which electric-lighting and street-railway franchises were passed and a $500,000 bond issue for a municipal plant voted, will be contested by the Stone & Webster Management Association, as managers of the Dallas Electric Company.

Claim is made that voters were allowed to cast their ballot after the legal closing hour; that the election was not in accord to the city charter; and that the amendments did not receive votes equal to a majority of the qualified voters in the city.

The mayor has stated that the matter is being considered by the city attorney and that the city will pursue its proper legal course. He feels that the election was legal and maintains his stand that the franchises will be put into effect. No official action, however, has yet been taken by the city.

Independent Electrical Jobbers Elect Officers.

The annual meeting of the Metropolitan Independent Jobbers' Association was held at its quarters in New York City on Monday evening, April 10, 1916, with C. P. LaShelle, presiding. There was a remarkably large attendance of members, and also of representative independent jobbers from Chicago, Boston, and other cities. All those attending the meeting expressed enthusiasm over the success of the Association, and what it had accomplished during the past year. Important plans were made for the coming year, and there was exhibited every evidence of even greater co-operation among the independent jobbers, than during the successful year just closed.

The following officers were unanimously chosen for the ensuing year:

President, C. P. LaShelle.
Vice-president, L. D. Baily.
Treasurer, Meyer Zucker.
Secretary, Meyer Rutkin.

Electrified Oat and Potato Crops.

Miss Dudgeon, of Dumfries, Scotland, has for some years conducted important experiments observing the effects of electricity upon the growth of potato and oat crops. Most satisfactory results were experienced with the potato crops in three successive years, the increased yield per acre with electricity being 1,204 pounds in 1912, 1,456 pounds in 1913, and 2,576 pounds in 1914.

In oats the difference was most conspicuous right from the beginning of the experiment, and the electrically treated crops suffered less than others from the drought which prevailed. The difference amounted to 31 per cent in grain and 31 per cent in straw in favor of electricity. The Dumfries' experiments prove that under the influence of the electric discharge the ingredients in the soil are more soluble and more easy of assimilation; that by the aid of electric current sap is enabled to flow more vigorously and the formation of sugar and starch increases; also that respiration, absorption and evaporation are accelerated.

Miscellaneous NEWS NOTES

Lectures on Thermoprotection.—Sidney N. Baruch, chief electrical engineer of the Baruch Electric Controller Corporation, San Francisco, Cal., an authority on thermoprotection of electrical apparatus and thermoelectrostatic protection of cables, lectured on these subjects April 18 at the University of California.

Wireless Patents Sustained.—The Italian courts have sustained the priority of invention by Alessandro Artom of the triangular dirigible aerials and the radiogoniometer as set forth in Italian patents Nos. 88,765 and 88,766, German patent No. 203,139 and French patent No. 378,186. Priority in the case of the radiogoniometer was claimed by Bellini and Tosi.

Thieves Steal Copper.—Sensing the high value of copper, thieves at Lynn, Mass., removed 3,600 feet of feed wire serving a pumping station, a stretch of 12 poles being stripped. The wire was the property of the Lynn Gas & Electric Company and was valued at $870. The line carried 2,300 volts, and it evidently was removed by men who were able to take the necessary precautions.

Youngstown Plant Short-Circuited by Kite.—The Lowellville plant of the Consolidated Gas & Electric Company, Youngstown, O., was out of commission for a quarter of an hour a few days ago as a result of a kite-string breaking. The kite fell across the wires and caused a short circuit, interrupting service in various parts of the city for about fifteen minutes.

Long-Distance Cable to Havana.—Announcement has been made by the American Telephone & Telegraph Company, that soon after the long-distance telephone line has been completed to Key West Fla., the next step will be the laying of a submarine cable between Key West and Havana. When the work has been completed the Cuban capital will be provided with direct long-distance telephone connection with the Bell system in this country.

Contracts Declared Invalid by State.—Nine contracts inherited by the Richmond (Ind.) municipal plant through the purchase of the electric plant of the Richmond Light, Heat & Power Company were declared invalid by the Indiana Public Utilities Commission. These contracts were entered into prior to the establishment of the Commission, and were, for the most part, rate agreements lower than the printed rate schedules of the company. These patrons must accept regularly established rates.

Ohio Companies Consolidate.—The Lorain County Electric Company, Elyria, O., has purchased the electric properties of the Ely Realty Company, the Elyria Milling & Power Company and the Citizens Gas & Electric Company, all of Elyria. During the past three years the business of the Lorain company has been conducted first in the name of George E. Milligan, and later in that of R. E. Burger, Agent. These trade titles have been displaced and the properties will be operated under the name of the Lorain County Electric Company, of which J. B. Johnson is general manager.

New Research Laboratory at M. I. T. Contains Unusual Equipment.—The Electrical Research Laboratory at the new Massachusetts Institute of Technology, Cambridge, Mass., will be situated under the central dome and in the east extension. Its equipment will include the finest collection of artificial electric conduction lines in the world. There will be a 2,000-Nautical mile artificial submarine cable, corresponding in character to usual under-water telegraph cables, a 2,500-mile long-distance aerial telephone line, a 35-mile artificial telephone submarine line and two artificial power transmission lines 800 miles in length. The laboratory will have a number of measuring devices of unusual type, and a large amount of specially built research apparatus.

Manufacture of Chemicals by Electricity Described.—J. W. Beckman, electrochemical engineer with the Great Western Power Company, San Francisco, Cal., presented a paper before a recent meeting of the company section of the National Electric Light Association describing in detail the manufacture by electrical means of caustic soda and bleaching powder from sea salt and limestone as contemplated in the half-million dollar plant under construction at Pittsburg, Cal.

Canadian Pacific to Electrify in British Columbia.—The Canadian Pacific Railway is considering a plan to electrify its lines through the mountains on the British Columbia division, according to a statement made by Grant Hall, vice-president and general manager of the western lines. Ability to haul heavier loads with greater speed over the mountains, to master snow and cold, to effect economies in operation and to travel longer distances without overhauling were some of the arguments in favor of electrification given by Mr. Hall.

Edison Company of Boston Largest City Taxpayer.—The Edison Electric Illuminating Company of Boston continues to be the city's largest taxpayer, this year being assessed for $25,407,800, $7,157,800 being on real estate and $18,250,000 on personal property, the tax bill being $457,340, compared with $420,563 last year. The Edison company for several years has paid the largest personal property tax, but not until 1913 did it take front rank as the largest corporation taxpayer. The tax of the New England Telephone & Telegraph Company has more than doubled in the past three years, due to real estate holdings.

Public Utilities Discussed at Kansas City.—The first of a series of monthly dinners at which civic problems are to be discussed was held April 20 by the Real Estate Board of Kansas City, Mo., the subject being "Public Utilities." The chief speaker was Frederick C. Howe, Commissioner of Immigration at the Port of New York, whose subject was "Municipal Ownership." Mr. Howe declared himself in favor of municipal ownership of public utilities. E. M. Stevens, consulting engineer of the Kansas City (Kans.) municipal electric-lighting plant, gave a description of that plant and its operation.

Possibilities of Telephony Outlined at Boston.—J. J. Carty, chief engineer of the American Telephone & Telegraph Company, was the guest of a reception at Symphony Hall, Boston, April 19, when 1,500 employees of the New England company met and heard this distingushed telephone expert. Mr. Carty described some early experiences with the telephone and predicted that the time will come when it will be possible to talk around the world by wireless telephony. A demonstration between Boston and Tokyo is not far distant. Instead of reducing the use of wires, wireless will increase it, as it will not be possible for all mankind to use the air as one conductor. The real function of wireless will be between ships and with the shore, he thought.

County Held as a "Municipality."—The Board of Public Utility Commissioners of New Jersey has decided a novel issue in connection with the status of a county as considered with a municipality, holding that a county is a municipality within the meaning of the limited franchise act of 1906 of the state. The board accordingly has withheld approval of an ordinance granted by the Board of Freeholders of Middlesex County granting the New York Telephone Company permission to construct and operate a line across Park Avenue, near the Metuchen road, on the ground that the company in obtaining the municipal consent failed to comply with the provisions of the limited franchise act, which requires notice and a public hearing before the granting of a franchise.

Cleveland's New Street-Lighting Installation

Nitrogen-Filled Lamps in Specially Designed Antique Lanterns Used with Marked Success in Business District — Initial Cost Is $228 per Unit

The rapid extension of Cleveland's business district developed a demand for greater and more ornate lighting on streets which formerly had been used for residential purposes. Upon investigation it was deemed advisable to change the entire down-town lighting system. The question then arose as to what type of illuminant to choose and the style of globe or fixture in which it should be installed. The gas-filled tungsten was finally decided on for the following reasons:

First: Simplicity and reliability. There are no moving parts or intricate mechanisms to get out of order. With series transformers located near the lamp standard a break in the lamp circuit or lamp burn-out does not open the main circuit, but allows the remaining lamps to burn. The series transformer allows the use of a safe low voltage up the standard to the lamp.

Second: Uniform, unwavering illumination of high intensity on the streets and side walks. The system also furnishes adequate illumination for the lower portions of buildings without clashing with sign or window lighting.

Third: Low first cost per unit and estimated reasonable operating cost; unskilled labor being used for cleaning and lamp renewing.

The standard and lantern were designed especially for Cleveland, and have a pleasing and artistic daylight as well as night appearance. Ideas used by the Egyptians and Romans were incorporated in the design of the lantern; it has also some points of similarity to the lanterns used in the thoroughfares of ancient London. Mechanically it is constructed of heavy sheet copper, it being possible to renew independently any one panel of glass in case of breakage. One of the panels is hinged, allowing access to the interior for cleaning and renewing lamps. The over-all dimensions of the lantern are approximately 20 inches diameter by 30 inches in length. The column brings the light source about 15 feet from the ground.

The lamp is supported vertically, tip down, a Holophane refracting glass band surrounding the bulb from 25 degrees below to 30 degrees above the horizontal. This band diverts into useful directions light from the lower hemisphere which would produce glare and light from the upper hemisphere which might detract from sign lighting.

The standards are built with a cast-iron base, fluted-steel column and cast-iron capital, all of which are firmly held together by three one-inch tie rods. The shaft is thoroughly galvanized and guaranteed by the manufacturer for 20 years.

Lamps of 1,000 and 1,500 candlepower, 20 amperes, were used, the higher candlepower being used on the larger and more important streets. The spacing is 80 to 90 feet, standards being set opposite each other on each side of the street.

Alternating current from 4,000 to 5,000 volts is stepped down by individual transformers, placed in a manhole built near the base of the standard, to 20 volts, being that required for the lamp. These transformers are so designed that the maximum voltage created in the secondary when open is 110, which makes the installation very safe for lamp trimmers and in case of street accident. The primary cables are lead cased and carried through the

Night View of Cleveland Business Street Equipped with New Street-Lighting Units.

Euclid Avenue, Cleveland, Equipped with 1,200-Candlepower Type C Lamps in Special Lanterns.

streets in separate duct lines built just for this purpose.

The circuits are planned for 50 units in series. Each is supplied from a 6.6-ampere constant-current regulator, through the usual type of plug switching panels.

Though the installation is not fully completed, from the 630 standards so far installed the following cost figures have been derived. The entire equipment, including standards, lanterns, series transformers, ducts, manholes, cables and substation equipment cost $114,867.97 or $182.33 per unit. Adding to this the demand proportion of the main station and cables, brings the total initial investment chargeable to the "White Way" system to $142,167.97 or $225.66 per unit. Differentiating this for the 1,000-candlepower and the 1,500-candlepower units, the initial cost becomes $228.05 and $233.27, respectively.

During the limited time that the system has been in operation the results so far obtained show an operating maintenance cost for 2,000 hours annual burning service, of $47.49 for the 1,000-candlepower units and $55.56 for the 1,500-candlepower units. These figures include only the cost of lamp renewals, based on an estimated life of 1,000 hours burning and electricity at one cent per kilowatt-hour.

Consolidation Plans of New England Power Companies.

At a recent hearing at Boston before the Massachusetts Gas and Electric Light Commission on the petition of the Connecticut River Transmission Company and New England Power Company for consolidation, Henry I. Harriman, representing these two affiliated companies, which generate and distribute hydroelectric energy throughout central New England, stated that in the whole system there is about 3,500,000 pounds of copper, which if bought today, would cost about $500,000 more than when purchased. Steel transmission towers, 1,850 in all, which were purchased for $100 to $140 each when erected, now would cost at least $210 each. Mr. Harriman said he did not expect to see copper go back to 12 or 13 cents, but that a price around 20 cents is probable for the next five or six years.

Costs of the power company's four plants on the Deerfield River, in western Massachusetts, exclusive of lines, averaged less than $100 per installed horsepower. The cost of the 54 miles of lines first constructed averaged about $13,000, while the 127 miles of "new lines" cost an average of $11,000 per mile. The latter were built 10 towers to the mile, while earlier construction was with 14 per mile.

Comparative costs of transmision lines in various parts of the country were given as follows:

	Cost per Mile.
Keokuk Dam-St. Louis, 144 miles (involving heavy right-of-way costs)	$19,000
Big Creek to Los Angeles, 241 miles	17,000
White River to Seattle, Wash., 8 miles	18,000
Line from Montreal, Quebec, 5 miles	14,300
Turners Falls to Springfield, Mass., 43 miles	13,400
Average cost of Conn. River Trans. Co. lines	11,500
Average for the country, about	15,000

Recent expansion of the system was in the direction of tide water, a line being built from the Massachusetts-Rhode Island boundary to Pawtucket and Providence, where two steam plants are tied in, giving the system the benefit of efficient steam generation at seasons of low water, these plants taking power from the Transmission-Power Company at seasons of high water. The plants connected are those of the Narragansett Electric Lighting Company and the Blackstone Valley Gas & Electric Company. It was stated that the Power Company contemplated building a steam plant on Long Island Sound, but instead may contract with existing stations.

The proposal is to bring about a consolidation of all the companies in the system as opportunity offers. The total amount of securities is $26,261,000, the New England Company being the holding company for the system. By consolidation of the properties in Massachusetts outstanding securities will be reduced by $1,300,000, the stock of the Transmission Company now held as collateral for bonds of the Massachusetts Company, a holding company, to be retired.

The Transmission Company has $1,195,000 common stock and no bonds. It is proposed to reissue this stock, in the consolidation, in the form of $1,000,000 common and $195,000 preferred stock, and to issue securities amounting to $3,219,000 to acquire, by the New England Power Company—the new consolidated corporation—the "new lines" built and now owned by the New England Company.

Electricity in the Manufacture of Gears

A Description of the Process Involved and the Machines Used in Manufacturing Raw-Hide Gears, With Data on the Motor Equipment of a Typical Plant

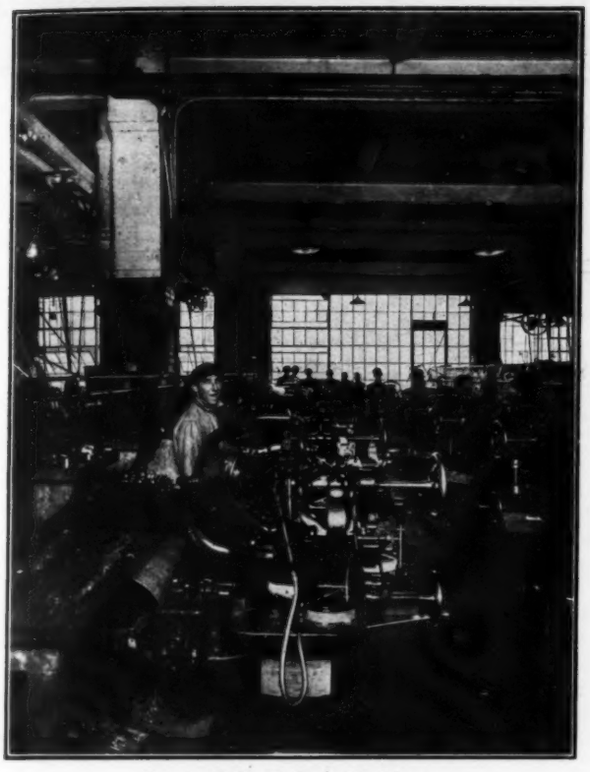
Industrial Power Series—Article No. 162

In this article the electric motor equipment of the New Process Gear Corporation is described, and the principal manufacturing processes outlined to illustrate the motor applications. This company manufactures "New Process" raw-hide gears, cut gears of steel and gears for automobiles. The gears cut include spur, bevel and internal types, in sizes up to 60 inches in diameter for spur gears; planed gears of 50 inches in diameter and under, and generated bevel gears from three to 12 pitch up to 18 inches in diameter. The plant contains over 200 special machines, including automatic and engine lathes for turning blanks from bar stock, castings and forgings; milling and hobbing machines, for spur, spiral and helical teeth; rotary cutters and planers for blocking out bevel teeth; Gleason generators for finish cutting bevel-gear teeth; Fellows planers for planing spur and internal gears; grinders for truing the bores of hardened steel gears; drilling, boring and milling machines; power presses, etc.

Both group and individual drives are used. The motors are squirrel-cage induction machines operating on a three-phase, 440-volt, 25-cycle system of distribution, the service being supplied by the Syracuse Lighting Company. The first process in the manufacture of raw-hide gears is the preliminary treating of the raw hides, where the thickness is reduced to about one-sixteenth of an inch. The suitable portions of the hides are blanked out into disks by three power punches and a disk cutter, group drives by a 10-horsepower motor operating at 1,725 revolutions per minute. This motor also drives a band saw. The disks range from 1.75 to 36 inches in diameter, as determined by the size of the gears to be cut from them.

Disks are then dipped into a vat of special glue, assembled between steel and blocks into a blank about 10 inches long, after which they are subjected to hydraulic pressure varying from one to 15 tons, depending upon the size of the disks. This process squeezes out the surplus glue and the blank is kept compressed for several days by drawing up nuts on surrounding stay bolts terminating in the metal end blocks. The outer diameter is turned in lathes and the blank sawed in pieces corresponding to the width of the gear face desired. The necessary turning, drilling, etc., are done by a group of machines consisting of 15 engine lathes, four small drill presses, and six Baker drills. These machines, together with a grinding machine and a tool grinder are group driven by a 20-horsepower motor operating at 1,735 revolutions per minute. The teeth are cut by four Brown & Sharpe gear cutters and a Prentiss gear cutter. These machines, together with six small engine

Group of Punches in Raw-Hide Department of Gear Factory, Driven by 15-Horsepower Motor.



Group of Small Gear Machines.

lathes, are driven by a 10-horsepower motor operating at 1,735 revolutions per minute. In this department there are seven broaching presses for forming square centers in gears, which are driven by a 10-horsepower motor with a speed of 1,725 revolutions per minute.

In the metal gear-cutting department there is an interesting individual motor installation consisting of 14 small gear-generating machines each driven by a two-horsepower motor through gearing. The starters are of the drum type and mounted on the machines in close proximity to the operator. The gear-generating machines are interesting, as the work done is entirely automatic. The gear blanks with the rough-cut teeth are placed in the machines and are cut to proper shape, the gear revolving the distance of one tooth as fast as each tooth is finished. As far as possible the work in the various departments is turned out on automatic machines. The accompanying motor data sheet enumerates the machines used together with the horsepower and the characteristics of the motors driving them.

Advantages of Motor Drive.

Within the last few years electric power in manufacturing establishments has become the rule rather than the exception, as it is realized that there is no problem of more vital interest to the manufacturer than that of obtaining a cheap, reliable, simple and continuous source of energy. This question is often the dominating factor in determining the location of a manufacturing plant.

There are many well-lighted, well-ventilated and easily accessible locations for shops and factories which would serve admirably for manufacturing purposes if power facilities were at hand. The electric motor sets aside the limiting features entirely and affords 24-hour service.

With the electric motor deriving its energy from a central station, there is a great deal of flexibility in the matter of power. All of the customers are never using the maximum at the same time and pay only for the actual energy used. Take the case of a circular saw, the power demand of which, under maximum working conditions, is five horsepower. If the manufacturing is of such a nature that the saw is used but intermittently, then where electric motor drive is used, electric energy would be charged for only in proportion to the work the saw performed. This argument applies to machinery of all classes. It is immaterial whether the manufacturing is carried on in the basement, first, second or third floors; one place is as acceptable as another for electric power. Where mechanical power is used, the manufacturer is dependent on the operation of an engine with the attendant shafts and belts. If any of these elements give out work must be suspended until repairs are made.

In the case of motor-driven machinery the problem is entirely different, as central-station service insures continuity of service. Another feature to consider is that the preparation of raw material in many industries occurs only through a part of the working day, and where mechanical drive is employed long shafts and belts must be operated uselessly for the other portions of the day. When such conditions exist it is difficult to determine whether the machinery is working at its best advantage or not, and whether there are any undue friction loads developing. With motor drive it is easy to determine from time to time the amount of power consumed when the machines are running light, and if this amount shows a perceptible increase at any time it indicates at once that there is undue friction which can be easily located and the necessary alterations or repairs made. This in itself is a valuable feature of electric drive, as it is often the means of discovering the abuse of the machines by the operatives.

The application of motors for driving machine tools in a manufacturing establishment may be divided into four

Group of Gear Generating Machines Driven by 25-Horsepower Motor.

Miscellaneous Machines in Rawhide Department, Motor-Driven.

classes: (1) Group drive at a constant speed. (2) Individual drive at a constant speed. (3) Individual drive at an adjustable speed. (4) Cranes, hoists, elevators, etc. The selection of the type of motor and the question of groups of individual drive depends upon the number of factors, viz., nature of the work, size or location of machine tool, percentage of time that machine is in operation.

In determining on the motor outfit for operating machine tools, one of the most difficult questions to decide is that of group or individual driving, and the most general solution is a combination of these two methods. The ideal method, and the one coming more and more into general use, is to have the motor form an integral part of the machine. This method entirely eliminates belting and shafting, both main-line and jack shafts. The saving in cost of these mechanical transmission parts partially compensates for the installation of motor and controller.

The slip of belts introduces an uncertain factor in power supply which is entirely absent with individual motor drive. Furthermore, with individual motor drive the power delivered to the driven machine is automatically controlled and, in case of heavy demands, may greatly exceed the rated power of the motors, even for considerable periods of time. Thus a motor-driven machine is always capable of maximum production, while with belt drive and poorly adjusted belts the machine frequently balks before the full capacity of the machine is reached.

The even and easily manipulated speed control of machines individually driven increases their productive capacity to a very material extent.

The advantages of individual motor drive may be summed up as follows:

(1) Better control and greater range in speed and closer speed regulation. The average increment of speed increases in a belt-driven machine tool is about 50 per cent. In an adjustable-speed motor it is 10 per cent to 20 per cent.

(2) Increased output and decreased cost of production,

Spur-Gear Cutting Machines Driven by a 35-Horsepower Motor.

due in part to increase in amount of power available in motor over that transmitted by belts.

(3) Increased light and cleanliness by elimination of dust and belting.

(4) Greater economy in transmission, especially when tools are running only part of the time, as there is no loss due to driving belts and shafting when the tools are idle.

(5) Reduced cost of repair and maintenance, owing to absence of shafts, hangers, pulleys and belts.

(6) Head room for cranes.

(7) More economical disposition of floor area and more convenient location of tools. Machines can be placed to best possible advantage with regard to light and sequence of operation. Additional tools can be readily added to equipment or location changed without any changes which are necessary in shafting when belt-driven tools are employed.

(8) Use of portable tools which permits of bringing one or more tools to the work and thus performing several operations at the same time.

(9) Reduced cost of buildings, as absence of shafting simplifies construction.

(10) Reduced cost in installation in many cases, especially for tools in isolated positions where expensive shafting and hangers would exceed cost of applying individual motors.

(11) Greater reliability and steadiness of power and freedom from stoppage of a number of tools, as in the case of a hot bearing or broken belt. Only the tool affected need be stopped.

MOTOR DATA.

New Process Gear Corporation, Syracuse, N. Y. Service from Syracuse Lighting Company; 440-volt; 3-phase; 25-cycle motors. Standard pulleys.

No.	Horse-power	Speed r.p.m.	Application
1	35	1735	Hand milling machine, small engine lathe, 30-inch engine lathe, 18-inch engine lathe, nine small boring mills, six hand turrett lathes.
1	35	1735	Four medium engine lathes, one grinding machine, eight milling machines, vertical grinding machine.
1	10	1720	Landis grinding machine.
1	10	1720	Landis grinding machine.
1	55	1735	Fourteen grinding machines.
1	35	1735	Thirteen Gleason gear generators, two shapers, large Gleason gear generator.
1	35	1725	Sixteen Gleason gear generators.
1	35	1725	Ten Gleason gear generators.
1	25	1735	Three Gleason gear generators, two Gould & Eberhardt gear shapers, grinding machine.
1	35	1735	Seventeen Gleason gear generators.
1	35	1735	Sixteen Gleason gear generators.
1	35	1735	Nine Gleason gear generators, seven Gould & Eberhardt blockers.
1	35	1735	Seventeen spur-gear cutting machines.
1	35	1735	Seventeen spur-gear cutting machines.
1	35	1725	Sixteen spur-gear cutting machines.
1	25	1725	Five Fellows gear shapers.
1	25	1735	Six vertical milling machines, five Landis grinders, screw threading machine, two Lucas presses.
1	35	1725	Grinder, twelve multiple drills, seven gear testing machines, nine large multiple drills.
1	10	1725	Three power punches, disk cutter, band saw.
1	20	1735	Fifteen medium engine lathes, four small presses, grind stone, six Baker drills, grinder.
1	35	1735	Seven broaching presses.
1	10	1725	Six small engine lathes, four B & S Gear cutters, Prentiss gear cutter.
1	10	1730	Three frog machines, two thread milling machines.
1	35	1725	Ten turrett lathes.
1	35	1735	Fourteen turrett lathes.
1	35	1735	Twenty-five turrett lathes.
1	25	1725	Four automatic screw machines, tool grinder.
1	25	1725	Six Automatic screw machines.
1	35	1725	Sixteen turrett lathes.
1	25	1735	Four turrett lathes.
1	25	1735	Two turrett lathes, five automatic screw machines.
1	25	1725	Seven automatic screw machines, four turrett lathes.
14	2	.....	Fourteen small gear generators.
1	20	1735	Fourteen gear generators.
1	25	1735	Ten automatic screw machines.
1	25	1725	Ten automatic screw machines, turrett lathe.
1	60	1725	Six gear facing machines, multiple drill, eight turrett lathes.
1	15	1725	Seven Automatic screw machines.
1	15	1725	Four cut-off saws, power hack saw.
1	25	1735	Ten Gleason gear generators.

Arrangements for Big N. E. L. A. Convention

Preparations for the great annual convention of the electricity supply men, with their thousands of allies and friends (counting the ladies as both allies and friends), are proceeding with great vigor and enthusiasm, both in Chicago, where the convention is to be held, and in New York, which is the headquarters of the association.

President E. W. Lloyd, of Chicago, is busily at work, and back of him is a general convention committee, of which Samuel Insull is chairman and Louis A. Ferguson is vice-chairman. In the New York office, Secretary T. C. Martin and his corps of assistants are as busy as the proverbial bees in pre-convention activity.

REMEMBER THIS

Event: Annual convention of the National Electric Light Association.

Time: May 22 to 26 (inclusive), 1916. Sessions Daily.

Place: Auditorium and Congress Hotels, Chicago

Preparations: Biggest Ever

The convention headquarters in Chicago will be in the Auditorium and Congress Hotels on Michigan Boulevard, overlooking Lake Michigan. According to the present plan there will be four convention halls, two in each hotel, so that four sections can meet simultaneously. The hotels face on Congress Street, as well as on Michigan Boulevard, and are connected by a marble-lined tunnel underneath Congress Street, so that visitors can proceed from any part of one of the large hotels to any part of the other without street wraps, in any stress of weather.

The exhibition of electrical appliances, in charge of the exhibition committee, of which J. Perry, of New York, is chairman and H. J. McConnaughy, of 229 Broadway, New York, is secretary, will be held in the large Auditorium Theater, which is in the same building as the Auditorium Hotel. The seats in the theater will be roofed over with a temporary floor and the exhibit booths will be placed here. Convention headquarters, registration booths, and the numerous other convention activities will be placed in the ante-room and foyers of the Auditorium Theater.

Committee reports and papers of the utmost value to the central-station industry will be presented at this convention. The program of papers is appended herewith.

Registration and transportation arrangements are announced in a "general information" circular issued from the New York office of the Association. The hotel committee has issued a circular giving a schedule of the principal hotels in Chicago, with their rates. This circular also contains a map of the central portion of Chicago, with convention headquarters and railroad terminals indicated. There will be three special trains, one from New York and Boston, via Buffalo and Cleveland; one from New York and Philadelphia, via Pittsburgh, and one from St. Louis. G. A. Freeman is master of transportation and E. A. Edkins is chairman of the hotel committee. Both may be addressed at 72 West Adams Street, Chicago.

A special registration circular has been prepared for the local Class B members by O. R. Hogue, chairman of the local registration sub-committee of the general convention committee. The circular gives instructions to the local Class B members—that is, the Class B members of the N. E. L. A. who reside in Chicago and its immediate vicinity—in relation to advance registration. Every effort will be made this year to make the registration, both of out-of-town and local members, as easy and as expeditious as possible. As an attendance of 5,000 is expected, this is a considerable undertaking in itself.

The entertainment committee of the general committee, of which Homer E. Niesz, 72 West Adams Street, Chicago is chairman, is not quite ready to announce its plans. It hints knowingly that it has something pretty clever up its sleeve. However, there will be the usual opening reception, a grand rejuvenation of the Jovian Order, automobile rides, an afternoon tea for the ladies, and some other big "stunts," which can only be hinted at vaguely at the present writing.

A special effort will be made to make the convention a memorable one for the visiting ladies. The ladies' auxiliary committee promises a very warm welcome to the women visitors.

A feature will be the visits to local industry points of interest. One committee, of which W. L. Abbott, 72 West Adams Street, is the chairman, is giving all its attention to this matter.

Tentative Program.

The program herewith indicates that a large amount of important business now arranged carries over until Friday, to say nothing of what may possibly develop in the meantime. There are three special new features of the program this year. In the first place, three sessions are occupied by the new Electric Vehicle Section, and in the second place two are devoted to the new Company Section Committee which is doing splendid work in the development of this branch of Association usefulness. The third item of change is that the Public Policy meeting will not be a big spectacular affair this year, but an executive session, open only to Class A operating companies and their representatives, to discuss and determine the inner matters of management and outer aspects of relationship to regulatory bodies. It will be noted that there are many new items on the program evidencing the broader and newer conditions of the industry. A more attractive program was never presented to the membership than that which follows:

TUESDAY, MAY 23, 10 A. M.

First General Session.

1—Welcome to the City—Mayor Thompson; 2—Address of President Lloyd; 3—Announcements; 4—Report of Committee on Organization of the Industry (Membership)—George Williams; 5—Report of the Secretary—T. C. Martin; 6—Report of Insurance Expert—W. H. Blood, Jr.; 7—Report of Committee on Progress—T. C. Martin; 8—Report on *Question Box*—S. A. Sewall; 9—Report of Committee on Relations with Educational Institutions—J. F. Gilchrist; 10—Report of Committee on Company Sections—F. J. Arnold.

TUESDAY, 2:30 P. M.

First Technical and Hydro-Electric Session.

1—Chairman's Address—Holton H. Scott; 2—Report of Committee on Meters—C. G. Durfee; 3—Report of Committee on Electrical Measurements, Values and Terminology—A. E. Kennelly; 4—Paper: *Lightning Protection for Transformers*—D. W. Roper.

TUESDAY, 2:30 P. M.

First Accounting Session.

1—Chairman's Address—H. M. Edwards; 2—Election of Nominating Committee; 3—Report of Executive Committee; 4—Report of Membership Committee—E. J. Allegaert; 5—Report of Committee on Classification of Accounts—Wm. Schmidt, Jr.; 6—Report of Committee on Cost Accounting and Statistics—T. J. Walsh; 7—Report of the Library Committee—Alex Holme.

TUESDAY, 2:30 P. M.

First Commercial Session.

1—Chairman's Address—J. F. Becker; 2—Report of Committee on Finance—E. A. Edkins; 3—Report of Committee on Membership—H. N. McConnell; 4—Report of Committee on Publications—C. A. Littlefield; 5—Report of Committee on

Salesman's Hand Book—M. S. Seelman; 6—Report of Committee on Education of Salesmen—F. R. Jenkins; 7—Paper: *The Way to Make a Salesman*—Earl E. Whitehorne; 8—Report of Committee on Merchandising and Recent Developments in Electrical Appliances—W. G. Stetson.

TUESDAY EVENING, 8:30 P. M.

Second General and Executive Session.

1—Report of Committee on Public Policy—W. W. Freeman; 2—Report of Committee on Taxation of Public Utilities—John A. Britton.

WEDNESDAY, MAY 24, 10 A. M.

Second Accounting Session.

1—Report of Committee on Form of Annual Report—C. H. Hodskinson; 2—Report of Committee on Customers' Records—E. J. Fowler; 3—Report of Committee on Purchasing and Storeroom Accounting—H. F. Frasse.

WEDNESDAY, 10 A. M.

Second Commercial Session.

1—Report of Committee on Wiring—R. S. Hale; 2—Report of Committee on Lamps—Frank W. Smith; 3—Report of Committee on Electric Ranges—W. R. Putnam; 4—Election of Committee on Nominations.

WEDNESDAY, 10 A. M.

Third General and Executive Session.

1—Report of Treasurer—W. H. Atkins; 2—Election of Committee on Nominations; 3—Report of Committee on Rate Research—Alex Dow; 4—Report of Committee on Constitution and By-Laws—R. S. Orr; 5—Report of Committee on Geographic Sections—Louis D. Gibbs; 6—Address: *The Society for Electrical Development*—J. M. Wakeman.

WEDNESDAY, 10 A. M.

First Electric Vehicle Session.

1—Address of Chairman—Walter H. Johnson; 2—Report of Secretary—A. Jackson Marshall; 3—Report of Treasurer—H. M. Edwards; 4—Report of Section Activities—Secretary Marshall; 5—Report of Committee on Membership—Joseph D. Israel; 6—Report of Committee on Standardization—E. R. Whitney; 7—Report of Committee on Motion-Picture Films—Carl H. Reed; 8—Report of Committee on Traffic and Good Roads—A. H. Manwaring; 9—Report of Committee on Insurance—Day Baker; 10—Election of Nominating Committee.

WEDNESDAY, 2:30 P. M.

Second Technical and Hydro-Electric Session.

1—Report of Committee on Underground Construction—E. B. Meyer; 2—Report of Committee on Overhead Line Construction and Inductive Interference—R. J. McClelland; 3—Report of Committee on Hydro and Transmission Progress—T. C. Martin.

WEDNESDAY, 2:30 P. M.

Third Commercial Session.

1—Report of Power Sales Bureau—C. J. Russell; 2—Paper: *Central Station Service in the Manufacture of Artificial Ice*—C. J. Carlsen; 3—Report of Committee on New Industrial Applications of Electricity—P. Torchio; 4—Report of Industrial Electric Heating Bureau—C. J. Hirshfeld.

WEDNESDAY, 2:30 P. M.

Second Electric Vehicle Session.

1—Report of Committee on Garages and Rates—George B. Foster; 2—Report of Committee on Legislation—P. D. Wagoner; 3—Report of Committee on Federal and Municipal Transportation—James H. McGraw; 4—Paper: *Industrial Truck Applications*—C. W. Squires; 5—Paper: *Electric Truck Problems and How to Minimize Them*—F. E. Whitney; 6—Paper: *The Relation of Tires to Electric Vehicle Efficiency*—S. N. Norton; 7—Paper: *Greater Garage Service*—Harry Salvat.

THURSDAY, MAY 25, 10 A. M.

Third Technical and Hydro-Electric Session.

1—Report of Committee on Accident Prevention—Martin J. Insull; 2—Report of Committee on Prime Movers—I. E. Moultrop; 3—Report of Committee on Electrical Apparatus—L. L. Elden.

THURSDAY, 10 A. M.

Third Accounting Session.

1—Paper: *Correspondence Course in Accounting*—A. L. Holme and J. R. Wildman; 2—Report of Committee on *Question Box*—Edwin A. Barrows; 3—Open Discussion and Experience Meeting; 4—Report of Committee on Nominations; 5—Election and Installation of Officers;—Adjournment.

THURSDAY, 10 A. M.

Fourth Commercial Session.

1—Report of Lighting Sales Bureau—John G. Learned; 2—Report of Committee on Commercial Aspects of Highway and Municipal Lighting—T. F. Kelly; 3—Report of Committee on Industrial and Yard Lighting—Oliver R. Hogue; 4—Lecture: *Lighting—A By-Product or a Buy Product* (Illustrated)—William A. Durgin.

THURSDAY, 10 A. M.

Third Electric Vehicle Session.

1—Report of Committee on Operating Records—W. P. Kennedy; 2—Report of Committee on Central-Station Co-operation—E. S. Mansfield; 3—Paper: *The Exchange Battery System*—P. D. Wagoner; 4—Paper: *Passenger Vehicle Problems and Activities*—E. P. Chalfant; 5—Paper: *Central-Station Promotion of Electric Vehicle Use*—W. P. Kennedy; 6—Report of Committee on Nominations; 7—Election and Installation of Officers;—Adjournment.

THURSDAY, 2:30 P. M.

Fourth Technical and Hydro-Electric Session.

1—Report of Committee on Street Lighting—S. B. Way; 2—Report of Committee on Power Supply for the Electrification of Steam Railroads—Peter Junkersfeld; 3—Paper: *Central-Station Electric Systems and Railroad Power*—F. Darlington.

THURSDAY, 2:30 P. M.

Fifth Commercial Session—Power Sales Bureau.

1—Paper: *Temporary Service for Municipal Sub-Service and Other Construction*—C. K. Nichols; 2—Paper: *The Resistance Heater as a Load Builder*—E. F. Collins; 3—Paper: *Electric Furnaces*—R. H. Tillman; 4—Paper: *Electric Welding*—S. R. Dresser; 5—Report of Committee on Competitive Power Sources—E. F. Tweedy.

THURSDAY, 2:30 P. M.

First Company Section Session.

1—Paper: *The Company Section and the Company*—M. S. Seelman, Jr.; 2—Paper: *Financing Company Sections*—A. L. Atmore; 3—Paper: *Company Section Educational Work*—Douglas S. Burnett; 4—Paper: *Company Section Entertainment and Recreation*—A. D. Bailey.

FRIDAY, MAY 26, 10 A. M.

Fourth General and Executive Session.

1—Awarding Doherty, Williams and Frasse prizes; 2—Report of Nominating Committee; 3—Report of Committee on President's Address; 4—Report of Committee on Memorials; 5—Report of Committee on Resolutions; 6—Election and Installation of Officers;—Adjournment.

FRIDAY, 10 A. M.

Sixth Commercial Session, Lighting Sales Bureau.

1—Report of Committee on Residence Lighting—Fred H. Scheel; 2—Report of Committee on Stores and Public Buildings—S. B. Burrows; 3—Report of Committee on Electrical Advertising—A. K. Young; 4—Election and Installation of Officers;—Adjournment.

FRIDAY, 10 A. M.

Second Company Section Session.

1—Paper: *Employees' Activities: Should They All Be Under the Auspices of the N. E. L. A. Company Section?*—J. D. Israel; 2—Formation and Methods of Conducting Company Sections—E. C. Stone; 3—Suggestions by Committee on Company Sections—F. J. Arnold;—Adjournment.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

COST OF SERVING RURAL CUSTOMERS AT KOKOMO.

Indiana Railways & Light Company Operates 13 Miles of Line, Serving 50 Customers.

By P. H. Palmer.

Although the supply of electricity to rural districts in Northern Indiana has been much considered and experimented with for several years, it cannot yet be looked upon as an established successful branch of the lighting and power business.

When we view an unsupplied field almost equal in population to that already within range of our service, we can hardly help but make an attempt to serve it, especially with our present fields becoming rapidly toward the point of saturation with the present common uses of electricity.

I take it for granted that each company has analyzed the urban residence lighting costs under the conditions pertaining to the operation of its particular system, and that the minds of the operators are pretty well made up as to whether or not their respective business at their present rate is a paying proposition. Therefore, in studying the cost of supplying the rural customer I shall deal only in the additional cost over and above that of supplying the urban residence customer.

Cost of Installation.

The Indiana Railways & Light Company of Kokomo, Ind., now has 13.11 miles of strictly rural line. By that I mean line feeding rural customers only. We also have considerable transmission line feeding small towns, but the rural supply was of secondary consideration in these cases, and location favorable to supplying rural business was not selected and that class of business was not catered to along these high-voltage lines, therefore we are not including them as rural supply lines.

The average cost per mile of our 13.11 miles of strictly rural line with transformers and service wires is $340, and the average number of customers per mile is 3.97, making an average cost per customer of $85.64, not including superintendence and intagible costs. Making a 15 per cent addition for these costs brings the investment per customer to $98.49. In several residence districts in towns we have found our average line, transformer and service wire costs to be about $48 per customer, including 25 per cent to cover superintendence and tangible costs. A lower figure was used for the intangible costs on the rural district on account of the financing mostly being taken care of by the farmer advancing $300 per mile for current to be supplied. This makes, in our case, an investment of $50.49 for the rural customer in excess of that required for the urban residence customer.

Assuming that capital cannot be brought into such projects for less than 8 per cent, and depreciation taken at 2 per cent, the additional cost for these two items is $5.05 per mile per customer. Pole renewals are not included in the above depreciation charge as the Indiana Public Service Commission classifies the renewal of poles and fixtures as maintenance cost. The additional cost per customer for maintenance, including pole renewals, is approximately $3.00 on account of the greater length of lines for more remote locations. For the latter reason the cost of meter reading and testing is about 50 cents per customer per year greater in the country, although meters are read only every three months.

About two one-kilowatt transformers are required on the average for every three rural customers. The core loss in the transformers at the average central-station cost, amounts to approximately 60 cents per customer per year in excess of the urban customer. This brings the total cost of serving a rural customer to $8.65 per year over and above that of supplying the town customer with the same class of service.

Assuming an arbitrary figure of 40 per cent of operating revenue as operating costs, would mean a necessary increase in business of $14.42 per year on the rural customer as compared with the urban customer.

Our average annual receipts per urban residence customer was $18.40 for the year 1915, while that of the farmer was $18.30 where it should have been $32.82 had the rural customer been on the same paying basis as the customer in town.

This means that the amount of sales to our rural customers will have to be increased $14.50 each per year in order for that class of business to pay a reasonable percentage on the investment.

It should be explained that the few miles of rural lines which we now have only touch the best territory, and should we undertake to cover our territory with service entirely different figures would be necessary. The investment per mile would be much greater and some of the other costs would be proportionately greater. We have not tried to estimate what the cost would be in that case as it is evident that extensions in communities paying less than those we now have should not be considered as prospects at this time.

We have put these few miles in as an experimental proposition with the hope of developing the same into a business that will pay not only on the present country installations, but give us the means of learning how to turn much larger rural areas into paying districts, and at the same time supply the farmer's wants.

Of course, when a paying basis is finally reached, it will have to be on a new figure which will necessarily take in the cost of development which will include the present loss in operation.

Farm Uses of Electricity.

The problem of developing the rural business into a paying proposition looks rather difficult to us. First the farmer will have to pay more for his current than the town customer. He will have to guarantee a minimum to comply with the figures given above. In order that he will willingly do this he must be made to see the advantages of greater use of electricity. Some of these uses may be mentioned briefly as follows:

Electric irrigation for truck gardening, the sad part of which is that the central station gets only about 10 per cent of the annual cost of irrigation. Pumping water for general purposes opens the way for about the easiest sale of current outside of lighting and ironing. Feed grinding by electric power appeals to the farmer. Our minimum is $1.00 per horsepower per month, and it is difficult to get a farmer to pay $60 per year for the required 5 horsepower to operate a

feed grinder, yet we do not feel that this can be reduced. We have hopes, however, that a one or two-horsepower feed grinder may appear on the market to relieve this situation.

A motor of one of these small sizes could serve as a general utility motor for grinding feed, pumping water, and domestic uses and would become very popular as the feed grinding could be accomplished with a smaller capacity in power.

Electric dairying affords a very hopeful opportunity and may bring in a very good revenue on the average. There will also be opportunities of developing electric cooking in the country as timber fuel becomes more scarce. The gas competition met with in cities is not often encountered in rural districts. The electric iron usually follows shortly after the connection for electric lighting and is introduced without difficulty.

We have not had experience with heavy electric uses on the farm, such as tractors, threshing machines, etc., and it would be necessary to work out the cost to supply these on a different basis, using heavier lines and transformers, and arrangements for portable operation, distributing current to various locations on each farm.

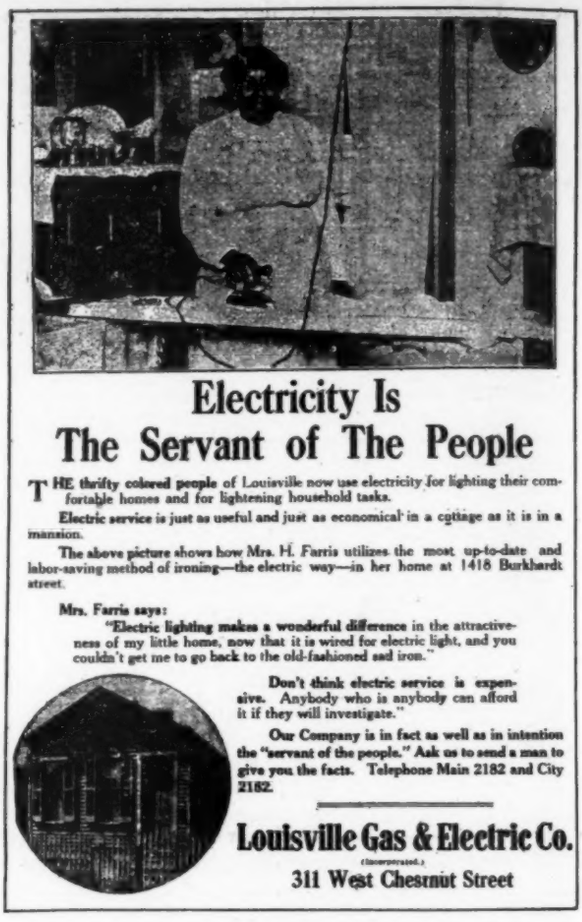
We are not discouraged regarding the rural business. We expected it to take time, and we believe that it will eventually develop into a paying business.

Salt Lake Company Advertises Apartments Equipped With Electric Ranges.

The accompanying illustration is a reproduction of a full-page advertisement appearing in the Salt Lake City daily papers, advertising apartment buildings equipped with electric ranges. The Utah Power & Light Company has been conducting a range campaign for sometime past and has been very successful in interesting owners of apartment buildings. The advantages of electric cooking are set forth in the advertisement and it is announced that a demonstration of electric cooking will be given at a cooking school.

COOL, COMFORTABLE KITCHENS!
Electric ranges in every one!
Some of the many apartment houses in Salt Lake where kitchens are equipped exclusively with ELECTRIC ranges
Utah Power & Light Co.
Efficient Public Service

Attractive Full-Page Advertisement of Utah Company Calling Attention to Range Installations.


Electricity Is
The Servant of The People
THE thrifty colored people of Louisville now use electricity for lighting their comfortable homes and for lightening household tasks.
Electric service is just as useful and just as economical in a cottage as it is in a mansion.
The above picture shows how Mrs. H. Farris utilizes the most up-to-date and labor-saving method of ironing—the electric way—in her home at 1418 Burkhardt street.
Mrs. Farris says:
"Electric lighting makes a wonderful difference in the attractiveness of my little home, now that it is wired for electric light, and you couldn't get me to go back to the old-fashioned sad iron."
Don't think electric service is expensive. Anybody who is anybody can afford it if they will investigate."
Our Company is in fact as well as in intention the "servant of the people." Ask us to send a man to give you the facts. Telephone Main 2182 and City 2182.
Louisville Gas & Electric Co.
(Incorporated.)
311 West Chestnut Street

Unique Advertisement of Louisville Company Directed Exclusively to the Negro Population. Much Excitement Was Created in the Colored District by This Publicity.

Advertisement Directed to Poorer Classes in Louisville Brings Returns.

Proceeding on the basis that the greatest field for extension of electrical service is among the poorer classes of the city, the Louisville Gas & Electric Company is making use of individual testimonials relating to the subject. A recent display advertisement in the local papers carried a three-column picture of the interior of a colored woman's house, with the colored woman at the ironing board, using, of course, an electric iron. "Electricity is the servant of the people," the advertisement began, and continued with the statement that the thrifty colored people of Louisville are now making use of electricity in their homes. Referring to the subject of the picture, the company gives her a title not customarily given to colored people south of the Ohio River, saying:

"The above picture shows how Mrs. Farris utilizes the most up-to-date and labor-saving method of ironing—the electric way—in her home at 1418 Burkhardt Street. Mrs. Farris says:

"'Electric lighting makes a wonderful difference in the attractiveness of my little home (which is pictured), now that it is wired for electric light, and you couldn't get me to go back to the old-fashioned sad iron.'"

There are many thousands of people in Louisville in the same circumstances as Mrs. Farris, and there is no doubt at all that this particular advertisement will get attention.

This is the first attempt of the Louisville company to interest the large negro population by means of advertising.

New England Companies Organize Wiring Campaigns.

The Salem (Mass.) Electric Lighting Company and the Malden Electric Company, both under the management of Charles H. Tenney & Company, Boston, Mass., have initiated house wiring campaigns. The Salem company turns over all contracts secured, to four local contracting firms, Lee & Osborne, F. L. Stanley, Marshall & Mithaud and Wilson & Emmerton. The company pays the contractor's bill as soon as the job is passed by the municipal inspector, and secures payment from the customer in 12 monthly installments, which are included in the monthly lighting bill.

The following are the unit prices at which the contracts are taken:

UNIT WIRING PRICES.

Service entrance	$9.00
Cellar outlet, including switch	5.00
Piazza, hall, parlor outlet and switch	6.75
Parlor outlet, electrolier	8.00
Dining room outlet, including switch	6.75
Dining room outlet, electrolier	8.00
Kitchen, pantry, china closet, back hall, second hall or other outlet, full socket	3.00
Bathroom, outlet switch	6.75
Floor receptacle outlets, first floor, with flush plug receptacle	4.50
Extra single-pole switch outlets	3.75
Three-way switches, set	9.00
Bryant heater control combination	4.50
Allowance for switches, except cellar	3.75

PRICES FOR FIXTURES.

Hall bronze tube and chain	$2.75
Porch, 6-inch ball	1.00
Parlor, 3-light shower fixture	6.50
Kitchen, pantry, long pendant tube	1.75
Bathroom, wall bracket, extends, 8-in	2.10
Dining room, 3-light chain shower	7.00
Bedroom, wall bracket	2.10

The company has mailed attractive circulars, with inclosures of illustrated fixture sheet and return postcard to each prospect. The plan enables each prospective customer to figure out for himself just what the wiring of his house will cost. In this way interest in electricity is stimulated.

The Malden Electric Company offers two group plans, one for $18 and one for $36, in either case payable 10 per cent down, and the balance in one year. The $18 offer covers service entrance, meter board, wiring to kitchen, drop-cord light, and flush receptacle for electric iron or other appliance.

The $36 offer includes wiring and fixtures complete for the first floor, including service entrance, meter board, four outlets wherever desired and flush receptacle for electrical appliance.

One or the other of these propositions is likely to form a basic for further inquiry, which the company will follow up by submitting a plan specially designed for the case.

When the job is passed the company pays the contractor's bill. Two contractors in each of the cities served—Malden, Medford, Melrose and Everett—share in the contracts. The business is carried on between company and customer, with no reference to the contractor's part in it.

Real-Estate Owners and Agents Solicited for House Wiring.

The Edison Company, of Boston, is making a special canvass of real-estate owners and agents who have to do with rented property. Two forms of letters are mailed to the owners and agents in each locality. The first letter points out the greater readiness with which electrically equipped houses are rented, and the increased profit, out of proportion to the investment, which results from installing electric lighting. Tenants are frequently glad to pay $2 a month more for a lighted home. This is $24 a year, or 20 per cent on an investment of $120.

The letter to dealers and agents points out that wired property sells much more readily than unwired, an investment of $100 oftentimes yielding twice that amount in the selling price.

The easy-payment plan applies to all property of this class. A return card is included with each letter.

A simple but forcible advertisement announcing its progress in house wiring is shown in the accompanying illustration placed in Boston newspapers by the Edison Company of that city. The policy of placing it in the "Real Estate" columns brings it to the attention of both house owners and real-estate dealers.

3500 HOUSES
Have Been Wired for Electricity on the
Edison Easy Payment Plan
No Interest Charges—Fits Any Pocketbook
Some Day? Why Not Now?
The Edison Electric Illuminating Company of Boston
Phone Oxford 3300, or nearest Edison Light Store

Advertisement of Boston Company Calling Attention to Progress Made in House-Wiring Campaign.

Minneapolis Company Secures 600 House-Wiring Contracts During Month.

The Minneapolis General Electric Company made a special effort to secure wiring of already-built houses during the period from March 15 to April 15, this being the month designated as "Wire-Your-Home Month" in a nation-wide campaign under the auspices of the Society for Electrical Development. The feature of the Minneapolis campaign was a flat price of $50 for the electric wiring and fixtures for a six-room house. Principal reliance was placed on newspaper advertising, with vigorous follow-up work by the company's salesmen, all of the wiring and fixtures contracts being turned over to the various electrical contractors in the city. During the period mentioned 595 already-built houses were equipped for electricity. Newspaper advertising produced 539 inquiries, at a cost of 83 cents per inquiry, advertising space used being that regularly employed by the company. The total amount of money expended by the public for wiring and fixtures was in excess of $40,000.

Six salesmen followed up the inquiries. The largest number of contracts closed by a single salesman during the one month was 127, although two others closed 125 contracts each. The campaign was planned and carried out under the direction of H. E. Young, sales manager of the Minneapolis General Electric Company.

POWER ENGINEERING

Problems Involving Motor Applications, Machine Characteristics, Power Sales Methods and Industrial Electric Heating

VARIED USES OF ELECTRIC HEAT IN INDUSTRIES.

Discussion at Boston Meeting Discloses Many Opportunities for Increasing Revenue From this Source.

In an address dealing with the uses of electric heat in industries, delivered by H. Fulwicer, of the General Electric Company, in Boston on April 13, many opportunities were shown for increasing the central-station revenue from this source. About 200 electrical men of Greater Boston, including central-station operators, contractors and manufacturers' agents, attended the meeting which was held under auspices of the New England Section, N. E. L. A.

Guy K. Dustin, of the Gas & Electric Improvement Company, Boston, presided. E. W. Lloyd, president of the National Electric Light Association, described the advantages of membership in that inclusive organization. The electrical business is too unprepared to meet the conditions that lie ahead, and closely coördinated relations between the several factors of the industry are very desirable. Manufacturers, jobbers, contractors and central-station men should work together to meet the problems that confront the industry, he said.

The production of atmospheric nitrogen will call for vast quantities of electrical energy, said Mr. Lloyd. In the manufacture of steel with the use of electric furnaces the United States was long laggard, but has come to be the leading country in the world.

Mr. Fulwider, in his address, said that the early applications of electric heating were usually due to lack of other kinds of fuel, or because manufacturers found resort to electricity more convenient; 90 per cent of the business came from the manufacturers without solicitation, and the other 10 per cent usually resulted from the securing of power business in combination. High- efficiency incandescent lighting, and the approaching saturation of the power field, leads central stations to turn to electric heating in industrial processes as a fertile field.

Almost every manufacturer may be regarded as a prospect for some application of electric heat. The success of this type of heat is due to the improved quality of work resulting, increased production, or local conditions such as reduction in fire hazard, rather than in actual fuel cost.

There are three general classes of heating units: (1) air heating units, which transmit heat to work by radiation; (2) the "hotplate" unit, with a surface containing the unit, for mounting on tanks or machines; and (3) the emersion type, placed in water, oil, soda solution, etc. Mr. Fulwider described the construction and uses of units of the three types.

One automobile manufacturer uses a 20 by 21 by 7 feet oven, with 264-kilowatt input, in the process of enameling automobiles. Heat control is had by an automatic thermostat. It is found that the electric oven is several times faster than the gas oven formerly used, as the latter type, with muffled open flame and the necessary ventilation for combustion, loses much in efficiency. Enamel formerly requiring 4 to 5 hours to bake, now is baked by electricity in 45 minutes at 500 degrees, the gas oven formerly producing 300 degrees. A large western automobile manufacturer increased his production 50 per cent. The close and constant regulation of temperature is a valuable feature. Though in some cases the actual cost of the electricity used is more than for gas, increased production more than offsets.

Another type of industrial oven is of the revolving type, the floor being a round turntable and the sides divided by a vertical partition. The whole structure is rotated by a motor, and one half is baking while the other half is being unloaded. Such an oven, 6 by 5 by 8 feet, has a maximum input of 67 kilowatts. A temperature of 500 degrees Fahrenheit is maintained with 34 kilowatts. The baking of 1,000 pounds of metal requires 67 kilowatt-hours.

Drying ovens are frequently being changed from gas to electric equipment. It is usually practicable to adapt electric heating to existing ovens, sometimes improving the insulation of the walls. One such renovated oven, 60 by 51 by 30 inches, calling for 22 kilowatts for maintaining 400 to 450 degrees, consumes 96 kilowatt-hours for a day's task. When gas was used for fuel, the same process took 3,000 cubic feet a day. The relative cost, with electricity at one cent per kilowatt-hour and gas at 70 cents per 1,000 cubic feet, is $2.10 and 96 cents, respectively, showing a saving of $1.14 daily since electricity was introduced.

The Sherardizing machine, for rust-proofing metal parts, is equipped with electrically heated units, which produce a superior finish. Tests made for months under salt spray showed that the metals carried a better coating than had been secured with other fuels. Drums for the Sherardizing process, 40 by 24 by 24 inches, take a maximum of 50 kilowatts, with 15 kilowatts to maintain a temperature of 600 to 700 degrees. The smaller size, 17 by 10 by 10 inches, takes 15 kilowatts, with 5 kilowatts to maintain. The capacity of the larger drum is 1,800 pounds of work, and of the smaller, 150 pounds. Three hours are required to put through the work.

Babbitt-melting pots consist of a crucible surrounded by a jacket, with a base heater unit in the base. Linotype-machine pots are another attractive source of central-station business. A few printers have adopted electricity in place of gas on the Mergenthaler machines, with satisfactory results.

An electric furnace for shrinking jackets on large naval guns is another interesting application. This is in 6 or 8 sections, each heated to 1,000 degrees by 30 kilowatts, 15 kilowatts being required to maintain that heat. The core consists of a cast-iron cylinder, with fire-brick lining, in a pit, into which the jacket is lowered and left several hours.

Oil tempering baths are in general use by tool manufacturers. These consist of an iron crucible with the units mounted on the side. Oil is heated to 450 or 500 degrees, a temperature near the flash point, and hence dangerous when an open-flame gas jet is used. Baths developed for the manufacturers of safety razors were among the first of this type. Lead-melting pots, in knife manufacture, glue-pots in binderies, and kettles for melting wax and pitch are electrically heated appurtenances that offer an attractive source of business for central stations. Hotplate type of heaters are supplanting steam tables for keeping celluloid in a workable condition.

Talks to Central-Station Power Salesmen

By C. H. Stevens
Manager, Power Engineering Bureau, Brooklyn Edison Company

This is the fourth of a series of articles by Mr. Stevens, in which he discusses the salient features of power-sales work. This installment deals with the organization and equipment of a power bureau, the suggestions being based on the methods used with such pronounced success by the Edison Electric Illuminating Company of Brooklyn. The concluding installment of the present series will be published in an early issue.

In selling power, as with most undertakings, success lies largely with the directing forces and organization. It is most essential that the individual salesmen receive help and co-operation from their office, in order to place their efforts in channels that will result in the greatest degree of efficiency.

In small companies employing perhaps one, two or three power men an elaborate organization, of course, is not required. Here the power engineer must depend more upon his own resources to meet the various obstacles in his path, as the problems he encounters are simpler and not so diversified as those met with in the larger fields. It is not necessary for him to have extensive follow-up systems, testing apparatus and records of plants in the field of operation as he is able to acquaint himself personally with all such concerns within a reasonably short time.

Power Sales Work Must Be Systematized.

While this is true in the smaller companies, the larger central stations appreciate the necessity of systematizing this work and have gathered data and developed systems of records which are found indispensable to the efficient selling of power. Such a system has been developed by the Edison Electric Illuminating Company of Brooklyn, and has proven of great value from an efficiency standpoint.

A brief outline of the operation of this Bureau is given herein for the consideration of other companies, though, of course, certain changes may have to be made to meet each central station's local conditions.

The personnel of this particular Power Bureau is shown graphically in Fig. 1.

The manager of the Power Engineering Bureau is held responsible for the entire operation of the Bureau and reports directly to the general sales agent of the company.

The power engineers are the men who directly handle the power sales. Great care has been exercised in selecting these men as the positions they hold with reference to the public, coming in contact with the largest manufacturers and business interests of the city, are extremely important to the company.

The assistant power engineers conduct all necessary tests on plants and work out propositions which are later presented for the consideration of private-plant operators. The assistant power engineers do not come in direct contact with the prospective customers, but are technical men of such caliber as will become power engineers when their practical training and experience fits them for the position.

The Brooklyn Edison Company has found it advisable and advantageous to have all plant testing done by the power sales force instead of by other departments such as the engineering or operating departments, as the men making the test are more vitally interested in the sale of power, also are more intimately associated with the men actually making the sale, and thus better results are obtained.

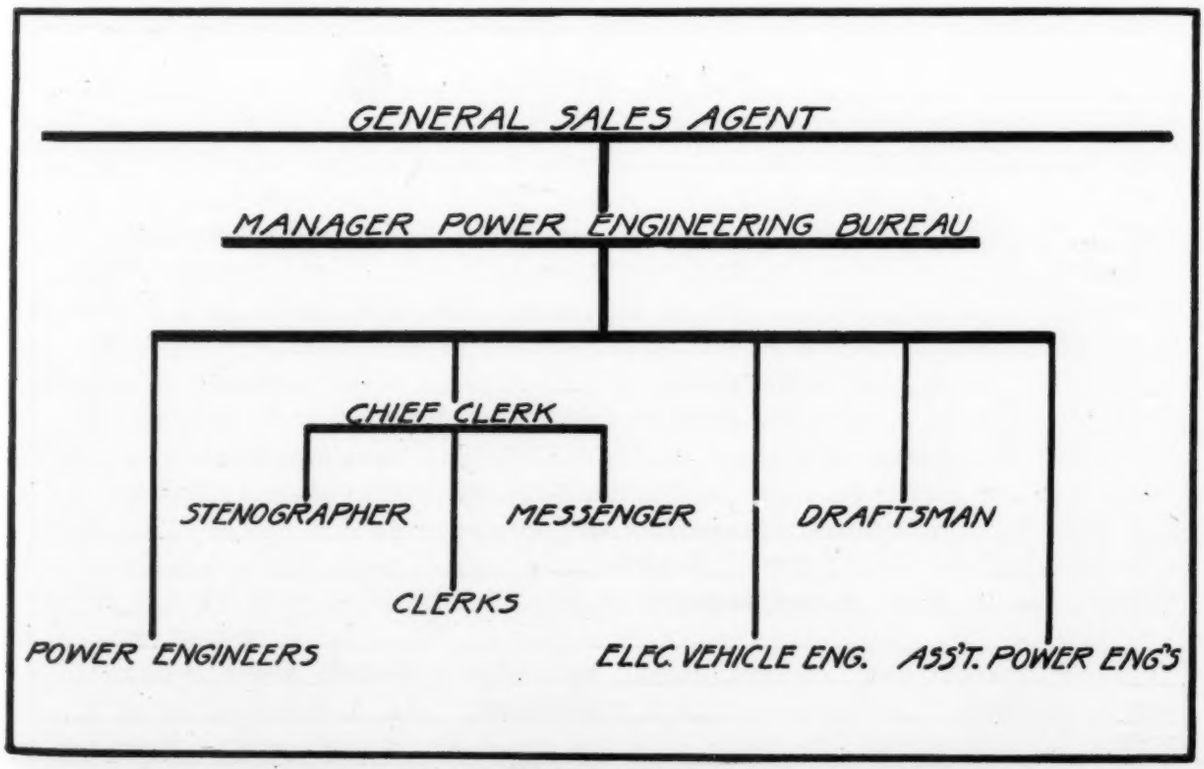


Fig. 1.—Organization Chart of the Power Engineering Bureau of the Brooklyn Edison Company.

467—C90368

INDEX SERIAL No. C-121

NAME Blank Bed Company,
ADDRESS 900 Mechanic Street
BUSINESS Metallic Beds

APPROX. H. P. 660 KIND OF DRIVE Electric

REMARKS

Fig. 2.—Index File—Plants Alphabetically Arranged.

468—C90369

INDUSTRY FILE SERIAL No. C-121

BUSINESS Metallic Beds

NAME Blank Bed Company,
ADDRESS 900 Mechanic Street
APPROX. H. P. 660 KIND OF DRIVE Electric

REMARKS

Fig. 4.—Industry File—Plants Arranged According to Industry.

Electric Vehicle Engineer Essential.

It is becoming more and more important that each power-sales force should have on its staff an electric-vehicle engineer with necessary assistants; one who is specialized and is thoroughly conversant with electric vehicles and vehicle storage batteries, as this branch of the work is growing very rapidly. In the Brooklyn Company this man has taken a course with one of the large vehicle manufacturers in order to thoroughly familiarize himself with the subject. It is necessary that this man keep in touch with the developments in vehicles, and should be the type of man who can, by clear arguments, completely dispel in the minds of those who are potential users of electric vehicles the erroneous ideas of having "peculiar conditions," which may forestall the application of such vehicles to their business.

Functions of Clerical Staff.

The clerical staff consists of the necessary clerks and stenographers to carry on the detail work of the Bureau. It has been found advisable to have an engineer as the chief of this staff, as it is quite necessary to have a man in the office at all times who can answer any inquiries a prospect or customer may make at the office regarding power; also he can better handle the manager's work in the latter's absence from the office.

The clerical staff maintains the follow-up system, files of correspondence, engineering data and engineering catalogs. It is the function of this staff to check all orders, compile various sales reports, and attend to the details of power-sales campaigns. Also, to keep the various files of the plant record, electric-garage record, available-factory-site and loft-building record and service inspection records. All of these are of great importance and each will be described later.

The Bureau equipment is complete in every detail. There is a reference library consisting of various engineering works on electric, steam, oil, gas and gas producer plants; books on heating, refrigeration and the many other phases of the power business.

The file system contains all correspondence relative to the power work, completed propositions and such miscellaneous data as may be needed for reference.

There is a testing laboratory equipped with engine indicators, steam-flow meters, draft gauges, tachometers, counters, various electrical instruments and other appa-

PLANT RECORD SERIAL No. C-121

NAME Blank Bed Company,
ADDRESS 900 Mechanic Street
BUSINESS Metallic Beds

NO. BOILERS 3 TOTAL H. P. 700 TYPE Fire Tube GAGE PRESURE 105
NO. ENGINES 3 TOTAL H. P. 575 TYPE Corliss AGE 6 COND. NON-COND. Non-Cond.
NO. DYNAMOS 2 TOTAL K. W. 350 A. C. D. C. D.C. VOLTS 250 PHASE
NO. MOTORS 20 TOTAL H. P. 660 TOTAL NO. LAMPS (INCANDESCENT) 1000 (ARC) 50
NO. ELEVATORS 1 TYPE Electric
ADDITIONAL APPARATUS 3 Deep Well Pumps and 2 Small Steam Hammers
HEATING SYSTEM Vacuum OTHER USE OF STEAM Drying Purposes
KIND OF COAL #1 Buckwheat TOTAL TONS PER YEAR 4500
HELP EMPLOYED 2 Engineers, 1 Electrician and 3 Firemen
APPROXIMATE COST OF POWER PER YEAR $23,000.
REMARKS See Mr. Brown, Factory Manager.

DATE 4/13/13 REPORTED BY A. B. C.

440—C85181

Fig. 3.—Plant-Record Card Containing Complete Data on Every Isolated Plant. The Reverse Side Is Shown in Fig. 6.

ratus that is required for making a complete and exhaustive test on a private plant.

The follow-up system is maintained so that various matters can be attended to at their proper time and dormant propositions followed up periodically.

Plant Record File.

As has been previously stated, it is unnecessary in a community in which there are a few private plants to have card records of them, as the salesman in a short time may familiarize himself with all of them. However, in the larger cities such a record is so important that a complete description is given of the Brooklyn Edison plant-record file. This record was obtained by having a canvass taken of all establishments in the field of operation, where any kind of power was used to the amount of 25 horsepower or more. At the time this census was made it was considered advisable not to include the plants of smaller capacity as they were not likely to be permanent establishments. The men detailed for this work were given loose-leaf books with data sheets, which, when properly filled out, gave a complete description of each plant visited. This information was taken from the field sheets and transferred to the plant-record cards in the form shown in Fig. 3.

A map of the area covered by the company is divided into sections of size convenient for handling and each section alphabetically labeled. A gum sticker is placed on the map for each plant corresponding to its geographical location. Various colors are used for different amounts of horsepower and each sticker numbered so that it corresponds to a certain plant-record card.

The plant-record cards are filed by section and numerically. By referring to the map one is able to determine the number and size of plants in any section or along certain streets. Growth of business for the central station can thus be predetermined and by referring to the plant-record cards by number, the names of the firms may be ascertained. It has been found that this is an excellent way for planning sales campaigns and when extensions are made to the lines the various plants on the extension

SALESMAN	A. B. C.
NAME	Blank Bed Company
ADDRESS	900 Mechanic Street
BUSINESS	Metallic Beds
SEE MR.	Brown, Gen. Mgr.
ARCHITECT	John Jones
ADDRESS	122 Woodard Street
CONSULTING ENG.	Henry James
ADDRESS	16 Lenox Street
DATE REC'D	

Fig. 5.—Salesman's Card of Prospects.

can be ascertained without leaving the office. An index file, alphabetically arranged, enables one to find any plant-record card and the plant's geographical location. Such a card is shown in Fig. 2.

There is also an industry file in which the cards are grouped by industry, as shown in Fig. 4. By referring to this file one can determine the number of establishments engaged in any particular industry. This file is of great value when sales campaigns are conducted in which particular attention is devoted to obtaining certain lines of business, such as woodworking, metal working, etc.

In conjunction with the plant record is the salesmen's follow-up file. This consists of cards of the form shown in Fig. 5, and each card represents a prospective customer. Data on this card consist of the prospect's name, address, name of party to be interviewed regarding power and an index number corresponding to the plant-record card.

Calls are followed up in this file by means of small metallic flags or markers of various colors which are attached to the cards, each color denoting the date for follow-up. The reports of the salesmen are entered on the backs of the plant-record cards and each prospect is followed until the business is secured or lost, after which the salesman's card is destroyed.

NAME ADDRESS

DATE	RESULT OF CALLS	ADV. SENT OUT DATE	ADV. SENT OUT FORM
2/11/14	Saw Mr. Brown, Gen.Mgr. re power from Edison mains. Thinks we cannot meet his costs but will consider proposition. Received permission to test plant.		
2/17/14	Plant tested. Saw Mr. Smith and left "Edison Power Pays" Adv.	2-16-14	E.P.P.
2/28/14	Saw Mr. Smith, Pres. re test figures and comparative proposition. Agrees to give yearly operating cost figures to me.		
3/4/14	Submitted complete proposition. Mr. Brown went over the cost figures. Proposition favorable. Will F.U. closely.		
3/12/14	Went over plant motor layout - quoted on cost of additional motors and submitted contracts to Mr. Brown. Will advise me.		
3/25/14	Saw Mr. Smith and Brown. Contracts executed with understanding that we give service in four weeks.		
4/16/14	Mr. Brown. Noted plant operating on Edison Service.		

LOST BUSINESS

CONTRACT SIGNED 3-25-14 TOTAL yes H. P. 660 FORM CONTRACT "B"

CONTRACT SIGNED PARTIAL H. P. BY A.B.C.

Fig. 6.—Data Card Giving Results of Calls on Prospect. Reverse Side Contains Complete Data on Plant.

The manager of the bureau by referring to the salesmen's cards is able to tell upon what propositions each salesman is working, and by referring to the reverse side plant-record cards, shown in Fig. 6, the status of each matter in hand can be learned.

For soliciting business and obtaining power prospects all the usual sales methods are employed, such as regular canvasses, advertising in papers and form letters. Leads are also secured from various sources such as the district agents, the daily records of new buildings to be erected, and then proper co-operation with electrical contractors, electrical manufacturers and their representatives, consulting engineers and the other departments of the Brooklyn Edison Company. Two methods which are somewhat out of the ordinary and have produced very good results are here described.

Follow-Up of Building Permits.

By following the city records of building permits information is obtained of all contemplated building projects. When plans are filed for a new building with the city a power engineer immediately gets in touch with the owners and their architects and consulting engineers to induce them to use central-station service for all lighting and power requirements. When the power engineer makes his first call all information which can be obtained regarding the proposed building and the power to be used is obtained and upon his return to the office a plant-record card is filled out with this information. This card is then placed in a file for incomplete plant-record cards. Reports of the power engineer's subsequent calls are noted on the back of this card and the building is followed up until its completion when the card is entirely filled out, given a serial number and placed in the completed plant-record file. Also a numbered sticker is placed on the map which corresponds to its geographical location. If the building is not equipped for Edison service, a private plant being installed instead, a complete report is made to the manager of the bureau as to why the proposition was lost, so that with any future propositions of similar nature different sales methods may be employed, which may give better results.

By referring to the reports of the city record and guide, a periodical which reports all new building projects, the manager of the bureau is informed of the project months before the building is started and is able to direct and advise the power engineers how to get the business.

A description of additional records used will be given in another issue.

Middleboro (Mass.) Municipal Plant to Buy Electricity.

The Middleboro (Mass.) municipal lighting department has made a five-year contract with the Plymouth Electric Light Company for the bulk supply of energy at a rate based on amount of energy used, ranging from 1.75 cents per kilowatt-hour for 500,000 hours per year, down to 1.55 cents for 1,500,000 hours. The plant's output last year was 464,000 kilowatt-hours. The new contract becomes effective about July 1, a tie line being built meanwhile, five miles of which, in Middleboro, is constructed by that town, and seven miles, outside the town, by the Plymouth company.

The present generating equipment of the Middleboro department consists of two generators aggregating 350 kilowatts, operated by producer-gas engines, and two water turbines developing 70 kilowatts. The town will maintain the former, for future use if desired, and will operate the water-power equipment as auxiliary to the purchased supply. Cost of production with the engines has averaged about 2.28 cents per kilowatt-hour, and with the water wheels less than one cent.

The town proposes to extend its lines into the neighboring town of Lakeville, for residence service. A line about five miles long will be built to supply 25 or 30 customers who have applied for service. George A. Philbrook, general manager and superintendent, has the matter in charge.

COMMONWEALTH EDISON COMPANY HAS RAPID INCREASE IN NEW POWER BUSINESS.

Connected-Load Contracts for Past Three Months Nearly Triple Those for Same Period Last Year.

A remarkable showing in new power business has been made during the past few months by the Commonwealth Edison Company, Chicago, Ill. The contracts obtained for new load connections since January 1, 1916, total nearly three times as much as during the same period last year and bespeak the growing utility of central-station service.

Some of the more prominent contracts for power closed recently are: Western Electric Company's group of buildings on Clinton Street, 3,000 horsepower; Stewart-Warner Speedometer Company, factory, 2,000 horsepower; General Chemical Company, 1,000 horsepower, displacing two turbo-generators; Wisconsin Steel Company, 2,000 horsepower; Edgewater Beach and Morrison Hotels.

Central-Station Service to Be Used for Municipal Pumping at St. Paul.

The city of St. Paul, Minn., has closed a contract with the Northern States Power Company for furnishing electric power for two 300-horsepower motors to be installed in the municipal pumping plant. These motors will operate during off-peak hours. The city decided to purchase central-station power as opposed to installing steam-turbine units of its own. The contract is for a period of five years, and current is delivered at 2,300 volts. The city of Minneapolis for a number of years has purchased electric power for operating its water works from the Northern States Power Company organization. Other cities in the Northern States Power Company's territory which use the service for municipal pumping include Mankato, Faribault, Minot, St. Peter, St. James and Waseca.

Electricity Cheapest for Flour Mills.

Millers who are members of the Central Kentucky Millers' Association have been exchanging experiences as to cost and desirability of the various kinds of power. They are mostly divided between steam and oil engines, although the Somerset Milling Company uses electric drive at a cost of $4.75 for 10 hours' run, with an average daily production of 95 barrels. The efficiency of the electric drive is plainly indicated by comparative figures. Among the steam-driven plants the reports show $3.50 for coal to an average output of 37 barrels; $4.15 for 30 barrels; $3.25 for 30 barrels; $3 for 25 barrels. The figures for the oil engines were not as plentifully stated. One miller reported oil cost of $2 per 25 barrels.

To Construct Electric Portable Saw Mills.

The Union Iron Works, Bangor, Me., is about to build portable band saw mills equipped with electric motors, for the Portable Band Saw Mill Company, of New York.

The electrically operated mill of the portable type is said to be rapidly gaining in favor among lumbermen. The use of such mills in states like Maine, having abundant water power developing electricity at low cost, is particularly advantageous. The demand for mills of this type is fast increasing in the west and south, according to the president of the company, which has placed a large order with the Bangor concern.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Rush of House-Wiring Business in Louisville.

Although Louisville (Ky.) electrical contractors, as previously noted by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, expected something of a rush in the way of house-wiring contracts before May 1, when the requirement of all-metal conduits goes into effect, they were not prepared for the rush that has developed. The top notch was reached during the third week in April, when one day saw 119 permits for house wiring issued by the city building inspector, practically all of them for original construction. It has been evident for some time that the contractors were not going to be able to get all the work done before May 1. At that time, it has been stated, the regulations will become effective automatically, and only jobs on which a bona fide beginning has been made on the present style construction will be approved for completion.

However, most of the local electrical contractors who are now taking orders for work have determined that they will carry out the holdover contracts on the same price basis. The difference will not be anything like as great in price as some people seem to think, and the contractors appreciate that the work they are going to do will give them the data they will need on which to base their later estimates.

Timely Hints to Electricians.

The Pennsylvania Department of Labor and Industry, Harrisburg, Pa., of which John Price Jackson is commissioner, has issued a folder entitled "Timely Hints to Electricians," and is ready to supply copies in any quantity.

From it the following useful hints that should prove of value to electricians anywhere are taken:

An electrician who is not familiar with or does not follow accepted standard practice in his repair and installation work is a constant menace to the safety of any establishment and its employees.

Shield your eyes from electric arcs or flashes. This kind of light frequently causes temporary blindness and in some cases ruins the eyesight. If you ever become so affected, consult the plant doctor or your own physican at once.

Small cuts, bruises or burns should receive treatment immediately and be protected from dirt or mechanical injury. Blood poisoning may set in and must be guarded against.

Keep your eyes on your hand when reaching for electric switches. Otherwise you may touch the "juice."

Before working on electric machines *lock* the service line switch *open* and place the key in your pocket. No person can then turn on the current with fatal results to yourself. This has often occurred.

Screwdrivers, pliers and all other handy tools should have insulated handles.

Immediately stop any abuse or misuse of electrical apparatus.

Never work on live circuits unless it is absolutely necessary. If you must work on such circuits, use all the safety devices and methods possible.

Treat all wires as "live" until you are absolutely sure they are "dead."

Unsafe or improperly working electrical apparatus should be immediately shut off and reported to the proper authorities.

In working overhead be careful to place tools so they cannot fall on persons underneath.

If working on ladders or scaffolds see that they are substantially built. If they are not, you may be the sufferer.

Use your safety belt whenever possible. It may be your "life preserver."

Never overload a circuit or use a fuse of too great capacity. Overheating of conductors may occur and the possibility of a fire is thus increased.

Study regulations for the proper installation of electrical apparatus. Never install wiring or other electrical apparatus which is not strictly in accordance with such rules. They have been formulated to prevent fires and accidents.

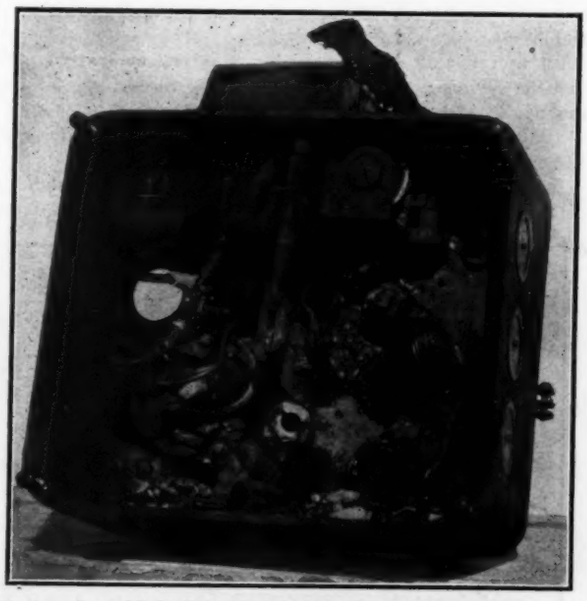
Do not have soldering torches burning unless you are present. Thoughtlessness in this matter on your part may cause considerable damage.

See that all combustible material is removed from places where a spark from electrical machinery or apparatus could ignite it.

Rat Short-Circuits Oil Switch.

The importance of keeping switches tightly closed where there is possibility of prowling vermin is emphasized by the illustration here shown.

This picture was taken after the switch had been opened



Interior of an Oil Switch After It Was Short-Circuited by a Rat. The Switch Mechanism Was Completely Ruined.

following the night prowlings of a large rat. The rat was completely burned up and the interior of the switch was completely ruined. The current caused by the short-circuit was so large that one of the main leads to the switch was melted.

Alternating-Current Motors—II

By Justin Lebovici

The first installment of this article explained the fundamental principles upon which the construction and performance of alternating-current motors are based. The present installment describes and illustrates the induction motor, and explains what is meant by a rotating magnetic field. The article will be concluded next week.

Classification and General Description of Alternating-Current Motors.

Alternating-current motors may be divided into two chief classes.

(*A*) *Synchronous motors.*—The characteristics of synchronous motors are very closely related to those of the alternator. Their field of application as industrial motors is limited to larger units, due to their requiring a direct current for excitation. In what follows we shall limit ourseves to the motors of class B, their field of application being more general.

(*B*) *Asynchronous motors.*—This class of motors is distinguished by the fact that the speed at which they can perform useful work is not determined by the number of poles and the frequency of the system, as in the case of synchronous motors.

Fig. 10.—Squirrel-Cage Induction Motor With Rails.

The asynchronous motors may be divided into two divisions: (1) induction motors and (2) commutator motors.

Induction motors and commutator motors are of both the single-phase and the polyphase types, but while the polyphase commutator motor is the exception, in single-phase work the commutator is a common feature of the medium and larger sizes. Common to both types is the low reluctance of the magnetic circuit.

Induction Motors.

Distinctive of the induction motor is the fact that the windings of only one member of the machine are connected to the line, usually the stationary member or stator, while the windings of the rotating member or rotor are either all short-circuited in themselves or arranged in groups which are short-circuited directly or through resistance. This gives a basis for subdivision of induction motors into (a) squirrel-cage motors; (b) slip-ring motors.

The rotors of these motors receive current through induction, the same as the secondary of a transformer; hence, the name primary is given to the member connected directly to the line, and the name secondary is given to the short-circuited member. In practice the stationary member is the primary and the rotating member the secondary.

Fig. 12.—Rotor of Slip-Ring Induction Motor.

Fig. 10 shows the general view of a squirrel-cage induction motor. Fig. 11 is a displayed view of a motor of the same type; Fig. 12 represents a slip-ring type of induction rotor.

In Fig. 11 we can distinguish the following stationary parts: the stator housing with its core and windings, usually referred to in practice as the stator, the bearing brackets and the bear-

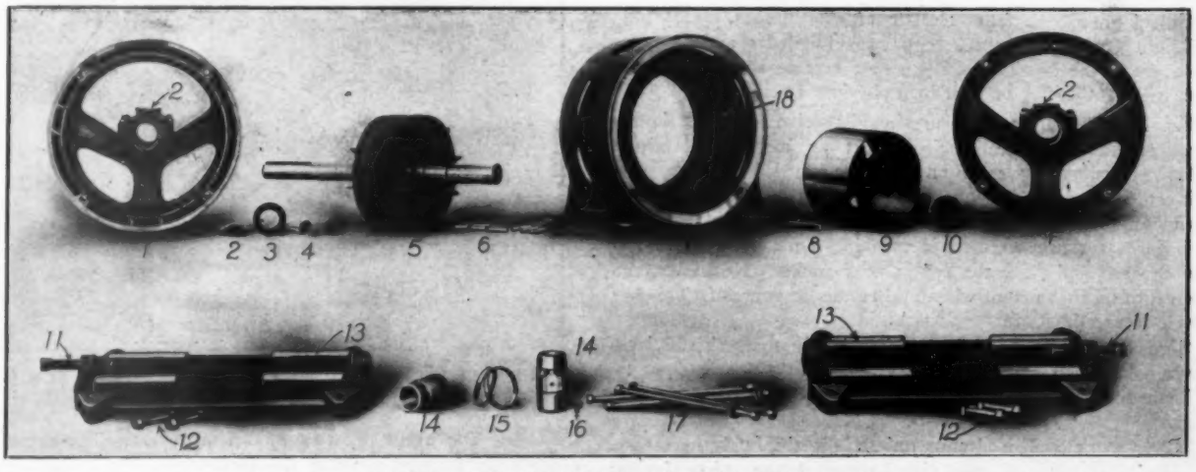


Fig. 11.—Parts of Squirrel-Cage Induction Motor.

1. Shields; 2. Oil-Hole Cover; 3. Inclosing Washer; 4. Oil Gauges; 5. Rotor; 6. Terminal Sleeves; 7. Stator; 8. Pulley Key; 9. Pulley; 10. Dust Cap; 11. Adjusting Screws; 12. Bolts for Stator Feet; 13. Rails; 14. Journal Boxes; 15. Oil Rings; 16. Journal-Box Set Screw; 17. Stator Studs; 18. Stator Coils.

ings. The stator housing is a cast-iron frame in which the laminations and windings are placed. The photograph of an assembled stator core and housing is shown in Fig. 13. The stator core is made up of disks punched from sheet steel, as illustrated in Fig. 14. These punchings are the laminations just referred to and are assembled in groups and placed in the housing as shown in Fig. 13. The windings are placed in the slots and insulated therefrom, as can be seen from Fig. 15.

A squirrel-cage rotor is shown in Fig. 16. The rotor core is made up of laminations clamped between end rings and secured to the shaft or spider. The rotor windings consist of insulated copper bars placed in partially closed slots. The ends of these bars are short-circuited through end rings of copper, brass or alloy.

The slip-ring rotor is similar in construction to the squirrel-

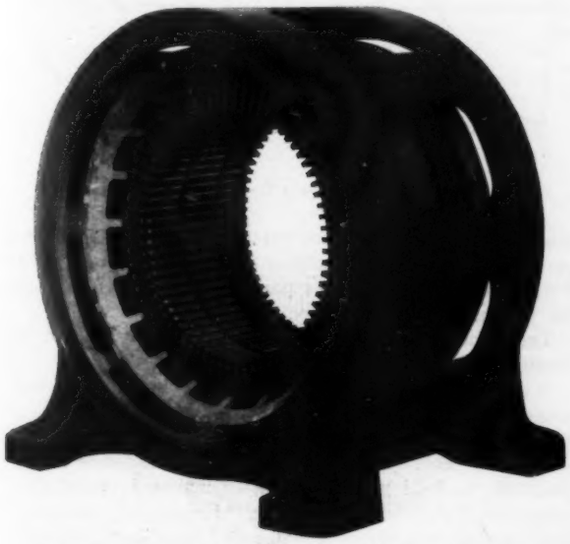


Fig. 13.—Stator of Induction Motor Without Windings.

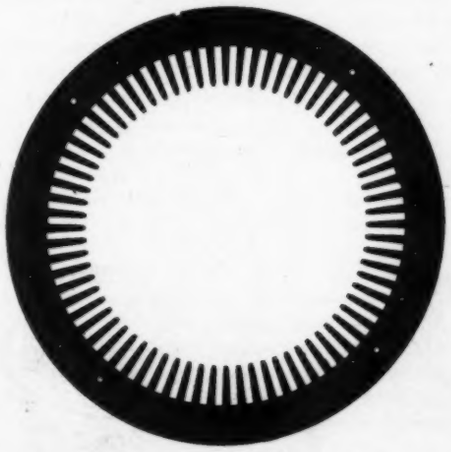


Fig. 14.—Steel Punchings for Stator Core.

cage rotor except that the rotor slots carry coils connected in roups in much the same manner as the stator windings. Leads are brought from the windings to slip rings. Brushes ride on these slip rings and from them the curent is taken to the controlling apparatus. Fans are provided on the rotor to aid in the ventilation of the motor.

Galileo Ferraris and Nikola Tesla were the first to show that it is possible to build alternating-current motors without using direct-current excitation. These motors are extremely simple in construction and can be economically built for either small or large outputs. The primary, when excited with polyphase alternating currents, produces (1) a revolving magnetic field, and when excited with a single-phase current produces (2) a single alternating magnetic field. The revolving field is constant (or nearly constant) in value and changes its position in space with a uniform (or non-uniform) speed. The alternating magnetic field does not change its direction in space but periodically changes its value from a maximum value in one direction to the same value in the opposite direction.

The Revolving Magnetic Field.

In Fig. 17, NS represents a permanent magnet supported in bearing B_1 and driven by means of a belt on the pulley A_1. EE represents a copper disk, free to move in the bearing B_2

Fig. 15.—Stator Windings.

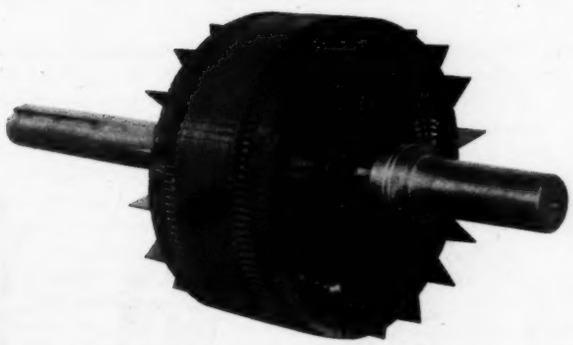


Fig. 16.—Rotor of Squirrel-Cage Induction Motor.

and carrying on its free end a pulley A_2. The lines of magnetic flux M close themselves through the copper disk. Driving the permanent magnet by means of belt and pulley A_1, we cause the copper disk to be cut by the flux and eddy currents are induced in the disk EE according to Lenz's law which tend to stop the movement of the magnet. If the torque on the belt A_1 is enough to overcome this opposing force, the disk EE will be forced to follow the movement of the magnet, and we may now use the pulley A_2 for driving a belt. We have transmitted energy from the pulley A_1 to the pulley A_2 through an air gap without the use of a mechanical coupling. If in place of the revolving permanent magnet we should use a revoving magnetic

field we would have in the above arrangement an alternating-current induction motor in its simplest form.

In order to show how a revolving field can be obtained by means of two or more windings on the stator, let us supply to the stator core shown in Figs. 19 to 23, two currents displaced by 90°, or a quarter period.

The instantaneous values of the currents supplied to the two windings I, I and II, II, displaced in space by 90°, are shown in Fig. 18. Figs. 19 to 23 may be imagined to be sections through the stator core. The part of the stator surface from which the magnetic field emerges we call a north pole.

At instant 19 in Fig. 18 the current in coil I (phase I) is a

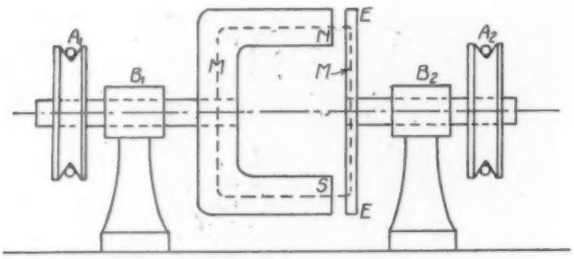


Fig. 17.—Generation of Electromotive Force by Induction.

maximum and in coil II (phase II) zero. We will indicate a current entering the plane of the paper by a circle and cross ⊕, a current coming towards the reader by a circle and dot ⊙. The distribution of current at the instant 19 in the two coils is shown in Fig. 19. The lines of magnetization produced by the coils are shown by dotted lines and the core surface will present two poles N and S as shown. A permanent magnet n s placed in the stator bore will assume the position shown in Fig. 19.

At the instant marked 20 in Fig. 18 the distribution of current and magnetism has changed and is as represented in Fig. 20. The current in phase I has decreased while the current in phase II has increased until they both have the same value and are both positive. We notice that the poles N S have moved 45 mechanical degrees while we moved through the same angle in Fig. 18. The permanent magnet n s will now assume the position shown in Fig. 20.

At the instant 21 the current in phase I has decreased to zero while the current in phase II has reached its maximum value. The poles N S and the permanent magnet n s have reached the position shown in Fig. 21. The poles N and S have the same strength in the three positions shown in Figs. 19, 20 and 21, but they have moved through an angle of 90° during a quarter period of time. In position 20 the current in I is less than it was in position 19, but the current in II has increased to the same value and the geometrical sum of the magnetic fields I and II has the same magnitude as the magnetic fields of I or II above in positions 19 or 21.

At the instant 22 the current in phase II has decreased to part its value in position 21, while the current in phase I has in-

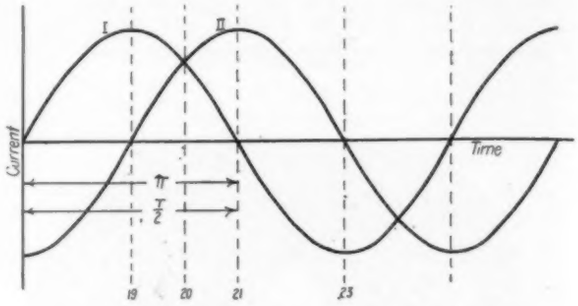


Fig. 18.—Instantaneous Values of the Currents.

creased to the same amount but in an opposite direction, and at the same time in a direction opposite to the one shown in Fig. 20 and instant 20. The position of the poles N S and of the permanent magnet n s are shown in Fig. 22.

The positions of poles N S and permanent magnet at the instant 23 are shown in Fig. 23.

We see that during half a period the poles N and S and the magnet n s have moved around 180°. During each cycle, then, the poles N S move around two poles or, in the case of a two-pole motor, through one revolution. In a two-pole motor the magnetic field of constant strength makes f revolutions per second if f represent the number of cycles per second. The field revolves in a two-pole motor 60 f times every minute.

It is at once apparent that the permanent magnet n s will follow the magnetic field, but if in place of a permanent magnet we substitute a copper cylinder or a squirrel-cage or a wound rotor, these will also follow the motion of the field for the same reason for which the disk EE in Fig. 17 started in motion; i. e., due to the currents induced in the rotor metal.

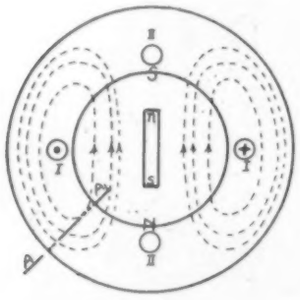


FIG 19

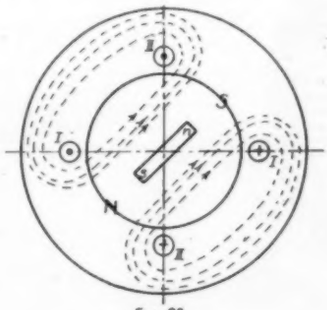


FIG. 20

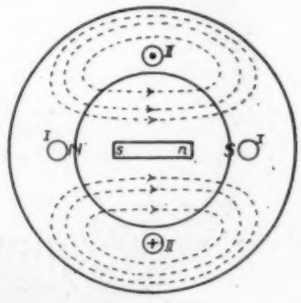


FIG. 21

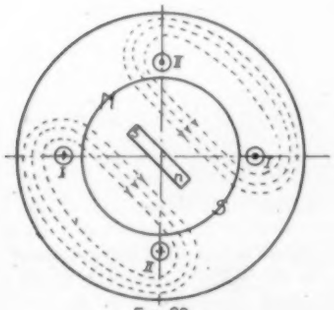


FIG. 22

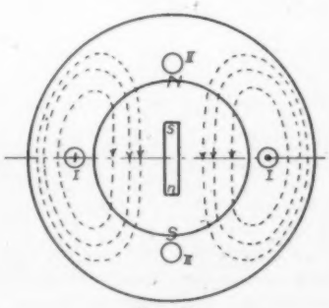


FIG. 23

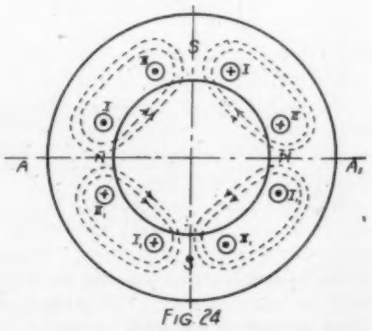


FIG. 24

We have shown how a revolving magnetic field can be produced by means of a two-phase current supplied to a two-phase stator of an induction motor.

Instead of a two-phase arrangement we could have chosen a three-phase system and the result would have been the same.

The current in coil II in Fig. 19 produces a simple alternating magnetic field in a horizontal line (or the X axis), while the current in the coil I produces a similar magnetic field in a vertical line (or Y axis). Assuming the electromotive forces applied to the two coils to be of the same value and frequency, but displaced in time a quarter period or 90 electrical degrees, then for a sinusoidal wave of electromotive force the instantaneous value of the magnetomotive force of the coil II is $H \cos 2\pi ft = H \cos \omega t$; and in the coil I, $H \sin \omega t$, if H be the maximum value of the magnetomotive force. As long as the iron is not saturated, the flux-density B can be taken as proportional to the magnetomotive force and we obtain for the magnetic inductions in the x and y axis the following values, shown graphically in Fig. 25.

$$\left.\begin{aligned} x = OA = B \cos \omega t \\ y = OD = B \sin \omega t \end{aligned}\right\} \quad \ldots\ldots (30)$$

The resultant of the two components is at every instant

$$\left.\begin{aligned} OC = \sqrt{OA^2 + OD^2} = \\ B\sqrt{\cos^2 \omega t + \sin^2 \omega t} = B \end{aligned}\right\} \quad \ldots\ldots (31)$$

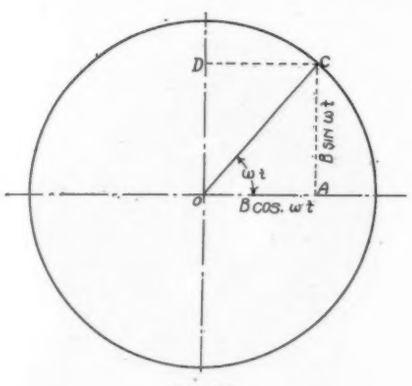


Fig. 25.

The resultant B is for every instant constant in value but revolves with a uniform velocity $\omega = 2\pi f$, hence the resultant magnetic field is constant and is revolving with a uniform velocity. Such a magnetic field is called a circular revolving field.

If the magnetomotive forces are not equal in value or the angle they make with each other differs from 90 electrical degrees, we will not obtain a circular revolving field and torque exerted by the field will not be uniform. Hence the importance of perfect symmetry in polyphase induction motors.

To produce a circular revolving field we need, generally speaking, n simple alternating magnetic fields of equal maximum value (amplitude) displaced in time phase by $2\pi/n$ degrees and spaced with reference to each other by the same angle. Fig. 18 gives us the value of the current at every instant of time and is a time diagram.

Figs. 19 to 23 show us the position of the resultant magnetic field in space at every instant and can be considered as space diagrams.

Imagine that the stator ring shown in Fig. 19 is cut open along the dotted line AA_1, then bent to a half circle as shown in the upper half of circle of Fig. 24 and another similar half added below. We obtain a four-pole stator. During the time corresponding to one cycle the magnetic field moves around the rotor axis a distance equal to two poles or in Fig. 25 a distance of 180°. The time corresponding to two cycles is necessary for a complete revolution. During one second, then, in the four-pole motor the field revolves $f/2$ times and during one minute the magnetic field revolves n_1 times, where

$$n_1 = 60f/2 = 30f \quad \ldots\ldots (32)$$

For the bipolar arrangement shown in Figs. 19 to 23 we had

$$n_1 = 60f/1 \quad \ldots\ldots (33)$$

But 1 in formula (33) and 2 in (32) represent the number of pairs of poles, and we can generally state that the speed of the revolving field in revolutions per minute

$$n_1 = 60f/p \quad \ldots\ldots (34)$$

where p equals half the number of poles of the motor.

Barring friction in the bearing, windage and other losses, the rotor of an induction motor running free would follow the revolving field the same as the permanent magnet in Figs. 19 to 23 and would run at the speed n_1. n_1 is called the synchronous speed of the motor.

Assume an eight-pole induction motor connected to a 60-cycle circuit. Then $f = 60$, $p = 4$, and the speed of the revolving field in revolutions per minute, according to (34), is

$$n_1 = 60 \times 60/4 = 900.$$

The Alternating Magnetic Field.

If the winding II in Fig. 19 should be left open and an alternating current supplied to the winding I, the same becomes the seat of magnetomotive forces and will produce a flux along the vertical axis. This flux will vary in magnitude and for low saturations will be at every instant proportional to the magnetomotive force, which may be assumed to vary according to a sine

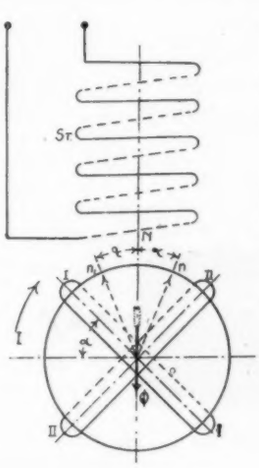


Fig. 26.

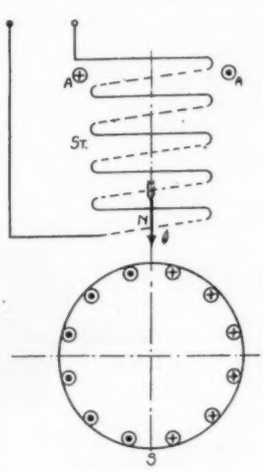


Fig. 27.

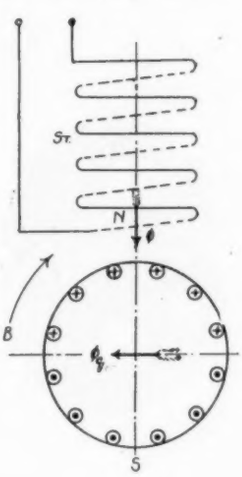


Fig. 28.

wave. We diagrammatically represent such a stator by a spiral St as shown in Fig. 26. The rotor may be represented by a circle. Assume one coil, I wound on the rotor, the same making an angle α with the horizontal. The flux ϕ produced by the stator coil St is in a vertical direction and induces a current in the coil I which according to Lenz's law produces a magnetic field of such a direction at every instant as to oppose the change in the field causing the current. The flux produced by this current is perpendicular to the plane of the coil and forms the same angle α with the vertical line. According to the law of Biot and Savart expressed in formula (26), a torque exists between the flux ϕ and the current in I which is proportional to the current in I, the flux ϕ and the sine of the angle α. Provided the torque is large enough, the rotor will turn until the plane of the coil I is perpendicular to the flux ϕ (or in other words until it is interlinked with the maximum amount of flux); at this instant the torque becomes zero. The direction in which the rotor would move under the influence of the current in the armature coil I and the field ϕ can easily be determined by noting that the coil I forms a north pole at n which is repelled by the north pole N on the stator field while ϕ is increasing. The rotor would move in the direction of the arrow I. If ϕ were decreasing in value, the current I would be in the opposite direction, and the force also would be reversed.

In a squirrel-cage rotor with many short-circuited coils we

will find for every coil I a second coil II whose normal to the plane of the coil forms with the vertical the same angle α, but to the left instead of to the right (as shown in Fig. 26). The coil II gives rise to the pole n_1 which is repulsed by the pole N in the opposite direction as n. The combined torque of coil I and coil II is then zero. The complete rotor, being made up of combinations like I and II, cannot produce any torque with the field flux ϕ.

The flux of the coils I and II, and in consequence the entire rotor windings, combine to oppose the main flux ϕ and behave towards the stator like the short-circuited secondary of a transformer.

It is an experimental fact that if the winding II in Fig. 19 is opened while the rotor (not shown in Fig. 19) is running, the rotor continues to run at approximately the same speed as before, the assumption being that the motor is not loaded. It is evident then that it is possible to produce a torque by means of a single-phase current supplied to the stator; but this is conditioned by a revolving rotor which is short-circuited along more than one axis. In order to produce a revolving field in a single-phase induction motor, the same has to be brought up to speed, and we shall investigate now the effect of the mechanical motion of the secondary in giving rise to a rotating field.

When the rotor is rotating at a certain speed in a single alternating field there are electromotive forces induced in the short-circuited turns by induction and by rotation.

Using in Fig. 27 the same notations as in Fig. 26, we note that due to the pulsation of the flux ϕ electromotive forces and currents are induced in the rotor winding, the direction of which can best be determined when we remember that these currents produce in turn fluxes which oppose the changes due to the stator currents. The direction of the currents shown in our diagram refer to only one instant, the current being alternating in character.

If the current in the stator coil for the instant we consider, has the direction shown in our conventional manner by AA in Fig. 27, and is increasing, the direction of the rotor currents for this instant is as indicated in the same figure.

If the rotor be moving across the field ϕ in the direction indicated by the arrow B in Fig. 28, there will be generated in each conductor an electromotive force proportional to the field and to the speed of rotation. The direction of the induced currents for a certain instant can be determined by remembering the following rule: For clockwise direction of rotation the electromotive force, induced in the armature by its cutting the magnetic flux, is directed away from the reader for the conductors under the north pole and towards the reader for the conductors under the south pole. If there be no lag the currets are grouped symmetrically around the horizontal and for the instant shown in Fig. 28 the flux ϕ_a, produced by these currents is from right to left. These electromotive forces have their maximum value when the flux ϕ is maximum. Due to the self-induction of the armature winding the flux ϕ_a lags behind the electromotive forces producing it. The fluxes ϕ and ϕ_a are displaced in space about 90°, and produce an elliptical field. It has been shown that an alternating flux cannot produce torque on a stationary squirrel cage, hence at starting the torque of the single-phase induction motor is zero. This single-phase induction motor has inherently no starting torque whatever, but will accelerate, if given an initial start, to nearly synchronous speed, provided the load is not too great.

The torque exerted by an elliptical field is not constant, because the instantaneous values of the rotating field to which the torque is due are not constant.

The rotor currents indicated in Fig. 24 (the energy currents) are displaced by nearly 90° in time from the flux ϕ; the quadrature flux ϕ_a is also displaced by nearly 90° from the flux ϕ. In consequence the rotor currents in the Y-axis are nearly in time phase with the flux ϕ_a and displaced therefrom in space by nearly a quarter period; these are most favorable conditions for producing torque.

A common method of starting a single-phase induction motor is the so-called split-phase method. The stator is wound similarly to a two-phase motor, but the impedance of the two windings, displaced from each other by 90 electrical degrees, is not the same. Due to the different impedances of the two windings, currents displaced in time phase will flow in the two circuits when connected in parallel to the line and the motor will start up as an imperfect two-phase motor. One of the windings (the so-called starting or teaser winding) is designed to be left in circuit only a very short time, a centrifugal switch being usually employed to open this circuit as soon as the motor has attained nearly full speed.

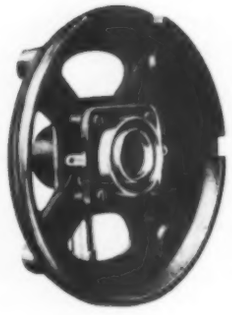


Fig. 29.

Fig. 30.

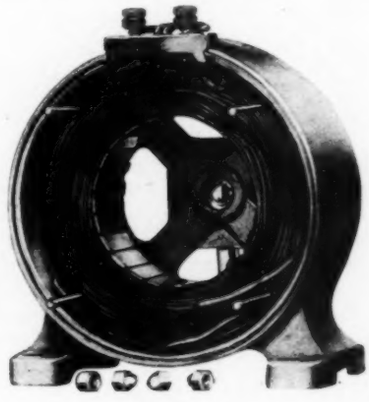


Fig. 31.

A motor of this type is shown in Figs. 29, 30 and 31. It is a one-eighth-horsepower, single-phase, split-phase winding. Fig. 30 shows the rotor core with the centrifugal switch. Fig. 29 shows the bracket with the slip rings through which the circuit of the starting winding is closed and opened. The fan shown on the rotor is characteristic of methods of ventilation of all modern motors.

Other methods of starting single-phase motors will be considered later on.

(To be continued.)

Water Powers of Europe.

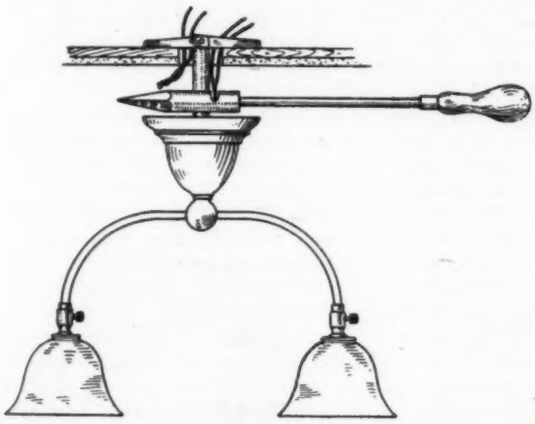
Statistics of the Imperial Russian Technical Society show the available water power in European Russia, including Finland, the Urals and Caucasia, to be roughly 30,000,000 horsepower, of which hardly 250,000 horsepower is utilized. The potential water power of Germany is about 1,000,000 horsepower; that of Switzerland 2,500,000 horsepower, and that of Sweden more than 6,000,000 horsepower. Of the latter about 3,500,000 horsepower is not yet utilized. In Switzerland 300,000 horsepower is utilized.

DOLLAR WIRING KINKS

Every reader is invited to contribute to this page. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Soldering in Close Places.

An easy way to solder joints in close and confined spaces is to take an ordinary soldering iron and file a groove in one side of it and tin it so that you can lay the joint into the groove. By doing this you will find that you can get



Grooved Soldering Iron for Work in Close Places.

into almost any corner and solder a joint in about half the time it requires to do it with a torch. The sketch shows how it is done in the case of fixture outlets.

Walter Morris.

Screws for Switch Outlets.

When flush switch or receptacle boxes are set too deep in the wall, as sometimes occurs when walls are stripped and back-plastered, the screws which come with the switch or receptacle are usually too short. Wood screws (No. 6 or 7) of the proper length can be screwed into the box-ear holes and hold the switch just as rigidly as the other screws would.

Benjamin Swanson.

Fishing Between Partitions.

In knob-and-tube-wiring in old houses it is often necessary to drop a fish line or mouse between partitions for a switch outlet, or some other purpose. In this case a weight must be put at the end of the string. Since a suitable weight is not always at hand, I have found that a piece of wire wound round itself serves satisfactorily as a weight. It is easily replaced should it become lost, as it frequently does.

Wire Weight.

S. B. Trunkat.

To Drill Glass.

It is sometimes necessary to drill a hole in glass intended for covering an instrument, etc. It is possible to drill glass very readily with a common drill and the use of a mixture of turpentine and camphor. When the point of the drill has come through, it should be taken out and the hole worked through with the point of a three-cornered file, having the edges ground sharp. Use the corners of the file to scrape the glass, rather than as a reamer. Care should be taken not to crack the glass or flake off parts of it in finishing the hole after the point of the drill has come through. Use the mixture freely, during the drilling and scraping. During the drilling the glass should be put on several layers of newspaper to prevent cracking the glass from uneven distribution of the pressure.

The above mixture will also be found useful in drilling cast iron. Tempered steel can be drilled by making a drill very hard and using this mixture.

F. A. Grohsmeyer.

Cutting Plaster for Outlets.

The following is a quick and neat way of cutting away plaster to make a hole for switch, bracket or ceiling boxes. Hold the open end of the box against the plaster on the exact spot where the outlet should be, then hammer on the back of the box, near the edge, so as to make the wall of the box cut the plaster. It is best to start near a corner of the box and work around. Most wiremen are afraid to use this scheme, fearing it will loosen a lot of plaster and make an irregular hole. With a little care, however, nearly all the plaster can be made to fall into the box.

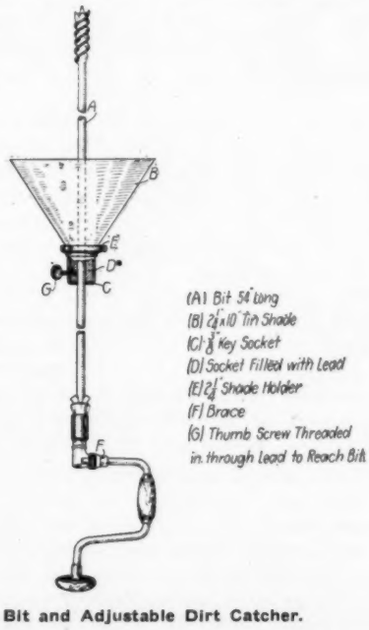
Charles Rubner.

Bit and Dirt Catcher for Boring Plastered Ceilings.

In wiring old houses I find that a bit about 4.5 feet long is very convenient. This is made by welding a rod onto the end of a regular bit and putting a shank on the other end of the rod.

Boring holes in plastered ceilings for fixture outlets has nearly always required two men—a wireman and helper—one to do the boring and the other to hold paper to catch the dirt. For this purpose I have found the following little scheme very convenient:

A three-eighths-inch key socket shell is filled with lead, ex-



Bit and Adjustable Dirt Catcher.

cept for a hole down through center the size of the rod or bit stem. An old 10-inch tin shade with 2.25-inch holder is attached to the socket; this is slipped over shank end of bit and fastened to bit rod at any desired point by a thumb screw, which is threaded into the lead, passing through the socket shell where the key originally went. A shade which is threaded to screw onto shade-holder ring is preferable, but separate shade and holder may be used, provided shade-holder is not ventilated, since an open holder would allow dirt to pass through.

Harry V. Light.

CORRESPONDENCE AND DISCUSSION

A Reader's Page Wherein Opinions on Topics of General Interest May Be Expressed

The Wood-Waste Problem.

To the Editor:

Regarding the article on page 463 of your March 11 issue on the subject of the wood-waste problem, I suppose our experiences in Milwaukee in connection with this subject are the same as those of power engineers throughout the country; that is, that most of our woodworking plants offer many obstacles to the utilization of purchased electric power. We have figured on a number of these plants but at the present time we are supplying the entire power requirements of none of them of any consequence. The conditions we have met are these: Most of them operate a dry kiln in which they dry a large part of their lumber. This usually utilizes exhaust steam throughout the year in a very considerable quantity. They all have a number of small uses for live and exhaust steam in the way of glue pots and cookers, heating boxes, and paint-drying rooms. The factory buildings have to be kept at a higher temperature than the ordinary shop or factory, so a large amount of exhaust steam is used for heating the buildings during the heating season, which in this climate includes about eight months of the year.

The above steam requirements make it necessary for these plants to operate boilers throughout the entire year requiring the attention of one or two firemen, depending upon whether the plant operates one or two shifts. This establishes a labor charge which cannot be eliminated by the use of purchased electric power and a charge which amounts to at least half of the cost of the firing force were a power plant operated.

Where they have a power plant the chief engineer usually acts as mechanical superintendent for the equipment throughout the plant. With purchased service it is necessary to have at least one handy man to take care of this work. With a non-condensing steam power plant, careful engineers are usually able to carry a large part of their steam requirements on exhaust steam from the engine. They cannot, of course, utilize all of their exhaust steam throughout the year because if they have sufficient exhaust steam in the winter season to take care of the heating in addition to the other requirements they will have a great deal going to waste in the summer months. On the other hand if their exhaust steam does not meet their entire requirements in the winter months they can at small additional expense use live steam.

In all of the plants in this vicinity there is a great deal of refuse, a large part of which has no greater value for any other purpose than for fuel. This refuse is in the form of shavings and sawdust, blocks and edgings. It is produced continuously throughout the year and must either be disposed of as produced or large storage capacity provided. There is here a fairly ready market for blocks and edgings for starting fires and for fuel. If it is sawed in short lengths and delivered it will bring more than its value as fuel. There seems to be no market of consequence for the shavings and sawdust and the only satisfactory disposition made of them thus far has been to burn them in the boilers.

The relative amount of refuse, of course, varies in different plants. In some cases they have enough to supply almost all of their fuel requirements, while in others they have to purchase a great deal of coal. The shavings and sawdust are usually delivered by exhausters to a chamber just back of the boiler-room firing floor or direct to the boilers. Their full fuel value is thereby utilized and the refuse is effectually and regularly disposed of.

We have felt in a number of cases that the refuse should be almost adequate to supply the steam requirements of the plant and that power could be purchased to advantage and the steam generated in a simple boiler plant by burning the refuse. When, however, a general balance sheet and a comparison of costs were made it has usually been found that this does not work out to advantage.

We have tried to investigate various schemes for disposing of shavings and sawdust, such as using it in the manufacture of wood alcohol, the manufacture of linoleum, collecting it at one central point and burning it in a power plant; but none of these schemes seem feasible at this time. We thought the wood-alcohol manufacture might open up a new field for the use of sawdust and shavings, but we are informed by the Wisconsin State Laboratory in charge of investigations along this line that it will not be an economical proposition for many years to come because in that production the first factories would be started at the large saw mills in the northern woods where there are millions of board feet of green sawdust going to waste every year. The linoleum manufacturer requires certain classes of sawdust of a uniform color and composition and this could not be obtained from the woodworking plants in the city.

Within the past year we made a survey of 25 of the largest woodworking plants in Milwaukee and vicinity. We found that they use about 150,000,000 board feet of lumber per year of various kinds; that 25 per cent of this, or 37,500,000 board feet becomes refuse and that one-third of the refuse is sawdust and shavings and two-thirds blocks and edgings.

Like all other industrial plants, each woodworking plant is a case for individual treatment and what may meet the conditions in one will not work out in another; in general, however, we do not consider woodworking plants a likely field for central-station power. They offer, however, a splendid field for the motor-salesman and we believe the time will soon arrive when there will be no more mechanically driven woodworking plants in the country.

These remarks probably throw no new light on this subject. We are anxiously awaiting some new developments which will enable us to find an opening in the woodworking industries.

F. A. Coffin,
Commercial Engineer,
The Milwaukee Electric Railway & Light Company.
Milwaukee, Wis.

Ground Test on Conduit Installations.

To the Editor;

Regarding the method of making a ground test on conduit or armored-cable installations described by M. J. Moriarty in a recent issue (page 555), I wish to call attention to the fact that, while the method is very sensitive in finding grounds, it is too sensitive to determine whether or not a conduit or cable is properly grounded. So poor a ground may be made as to be totally unfit for protective purposes and still give a very loud and distinct click in the receiver when tested. A faint click does not necessarily indicate a poor ground. The most effective method is to test the grounding with the full voltage of the system grounded.

H. E. Weightman.
Chicago, Ill.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to not over 300 words. Payment will be made for all answers published.

Questions.

No. 341.—Controller for Bascule Bridge.—A bridge-machinery designer has told me that it is impracticable to introduce any automatic control features for the motors operating bascule bridges because of the variable load due to wind, sleet, etc. Have any bridges of this type ever been equipped with automatic controllers, or at least automatic limit switches to prevent smashing or upsetting the bridge leaves or breaking the machinery from running too far?—W. W. G., Wilmette, Ill.

No. 342.—Trouble Finders.—Please have some one among the questions and answers contributors explain for me the principles on which the wireless electrical pipe and trouble finders are built and operated. Please show by simple diagrams the methods of wiring used in both the exploring coil and wave transmitter.—F. A. B., St. Joseph, Mich.

No. 344.—Life of Gas-Filled Lamps at Various Voltages.—What is the rated life of 110-volt Mazda "C" lamps at rated voltage and at voltages two per cent above and below rated voltage? If available, kindly give data on the life at various voltages ranging both ways from 110 volts up to eight per cent.—R. D., Washington, D. C.

Answers.

No. 336.—Visual and Audible Signal.—I should like to know whether it is possible (and if so, how) to wire a simple but positive signal system which will indicate at the same instant at the sending and receiving points by means of lighting red lamps and ringing large gongs for perhaps half a minute. That is, the man at the sending end must know positively by the lighting of his lamp and ringing of his gong that the combined signal was properly actuated at the receiving end without a special answer-back signal.—G. S. C., Joplin, Mo.

The accompanying diagrams will give the querist the details of a circuit such as he desires. The self-restoring, three-point keys are simply assembled, or may be procured from any supply house. The relays should be of approximately 20 ohms resistance, and preferably of the knife-edge armature type. A relay of this type operating on a circuit of from 21 to 24 volts is very positive in operation, with a current consumption of only from 0.015 to 0.020 ampere. This allows of its use on a circuit up to 1,000 ohms resistance one way. The bells should be wound for 24-volt operation, and the lamps designed for the same voltage.

If it is desired to use the circuit for telephone communication as well, any standard local-battery telephone connected across the circuit in series with a condenser of 2 microfarads capacity will give the desired result. In Figs. 1 and 2, letters *A*, *B* and *L* indicate corresponding terminals.

In a circuit designed by the writer, and placed in service in Buffalo, N. Y., some time ago, it was found advisable to take a tap wire from the stationary contacts of the bells to one side of the line, through a condenser of 1-microfarad capacity, and an extra contact in the telephone hook switch, this being the contact to which wire from the terminal *B* Fig. 2, is connected. This gives a positive answer-back signal from the distant station, since the receiver is removed from its hook while signaling, as a rule. It will be noticed that this tap wire must be connected to the opposite side of the line at each station, and also that polarity of main battery must be reversed at each station.

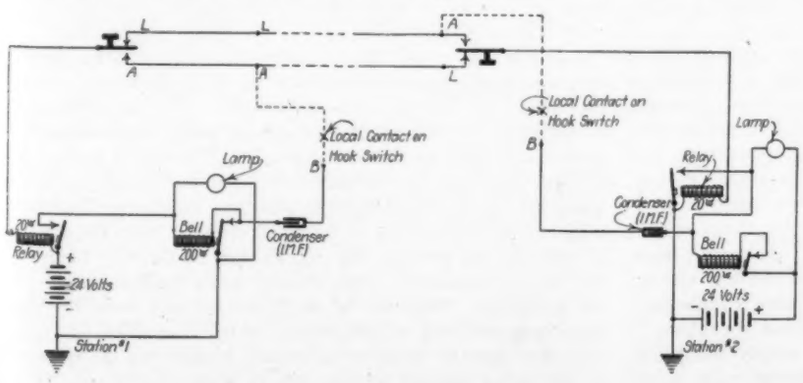
If it is intended to use the signal circuit only, bell-ringing transformers giving 20 to 25 volts on their secondaries may be used to supply the signaling current, and the tap wires from the bells may be omitted. All the equipment used is standard and may be procured from any reliable supply house.—A. C. F. L., Port Huron, Mich.

No. 339.—Telephones on Power Lines.—What precautions should be taken in installing telephones whose line is on the same poles with 11,000-volt power lines? What special precautions should be taken for safety? Would it be practical and would the service be satisfactory if a grounded circuit were used instead of a metallic circuit for the telephone line?—R. F. C., Minersville, Cal.

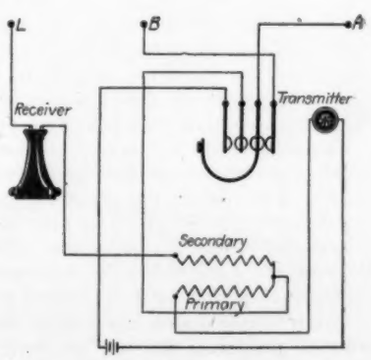
When a telephone line is installed on the same pole as a circuit carrying heavy current at low or high voltage it must be protected. The service must be protected from the current in the neighboring circuit where the voltage is low, while when the voltage is high the question of life risk as well as service also enters. The telephone lines for use of the public do not usually run on the same poles as the power lines. Such telephone lines are for the use of the employees of the power company, and their use by others is usually forbidden by the power company.

In power transmission work the same poles are often used for the power and telephone circuits because the route for the one is the logical one for the other, in this way obtaining economy of first cost, for maintenance and permitting the saving of valuable time during operating troubles. For circuits above about 60,000 volts a separate pole line is usually used for the telephone line, partly on account of the greater safety but also because of the effect of the high voltage upon speech over the telephone line. Separate pole lines should be not nearer than about 60 feet from the high-tension lines.

Where telephone lines parallel power lines there is always the possibility of interference due to the electromagnetic and electrostatic fields set up by the power line, and these



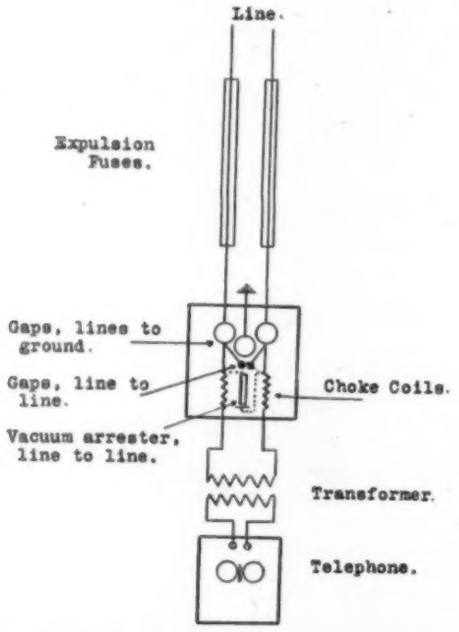
No. 336.—Fig. 1.—Visual and Audible Signal.



No. 336.—Fig. 2.

effects upon the talking properties of the telephone line must be guarded against, otherwise the bells may ring, receivers burn out, shocks be received and similar symptoms be encountered when short-circuits, grounds, sudden load changes, etc., occur on the high-voltage line. Climatic changes, especially when the insulation of the lines is not in the best condition, also enter, often making speech impossible of interpretation.

The quality of service of the telephone line may be safeguarded to a large extent by judicious spacing of the wires of the two circuits with respect to each other, transposing the lines, and maintaining the insulation of both circuits in first-class condition. When telephone lines are installed on the same poles as power circuits or even in close proximity to them, it is customary to transpose the telephone lines every 1,000 feet or so. Transpositions should not be made oftener than necessary, for making them costs money while too frequent transposition will often cause more harm than good. The power lines are often transposed also, but this is being done less now than it was at one time. In some cases where considerable trouble was encountered due to high voltage and heavy current surges, neutralizing transformers are used. The most notable instance of this is on the New York, New Haven & Hartford single-phase



No. 339.—Protection of Telephone on Power Line.

track, where the use of the track and earth caused considerable embarrassment for some time.

A telephone line with one side grounded almost always suffers more than one that is metallic throughout. It requires higher insulation on the ungrounded side, and is very much more susceptible to atmospheric conditions—moisture, etc. Where a telephone line parallels a power line, whether on the same pole or in very close proximity, the circuit should by all means be metallic throughout.

Not only must the speech characteristics be protected where a telephone line parallels a power line, but it is also necessary to protect the persons using the line from shock, and prevent the likelihood of fires starting. As a rule telephone companies do not allow circuits paralleling power lines on the same pole to be connected to their exchanges, although they may be if the proper precautions are taken.

Power transmission companies usually supply insulated wooden platforms for use of their employees who must use the telephones along their power lines. The wood is dry varnished wood supported on insulators. In addition to this many of them, particularly on really high-voltage circuits, 60,000 volts and above, insulate the telephone from the telephone circuit by means of a transformer specially built for this purpose. Lightning arresters are installed, as are also choke coils and fuses. The sketch shows the general arrangement of a protected telephone installation, applicable for voltages from 11,000 to 110,000 volts. These sets are supplied by the large manufacturers of electrical apparatus.—K. R., Chicago, Ill.

Telephone lines on high-tension power poles can be as safely and quietly operated as elsewhere, if the line is installed below the power line, say 10 or 12 feet or more, and transposed at frequent but equal distances. Then above the telephone circuit, or between it and the high-tension circuit, run an old iron wire, about No. 14 or larger, parallel with both telephone and power lines and ground it twice between each transposition of the telephone pairs.

Where entering building install type Y-109, form B telephone-lin: insulating transformers with lightning arrester and fuses. The transpositions should not be greater distances than one-fourth mile apart.—J. B. K., Torrance, Cal.

No. 343.—Theater Emergency Lights.—Rule 38*a* of the National Electrical Code provides that "where supply to a theater cannot be obtained from two separate sources, the feed for emergency lights must be taken from a point on the street side of main service fuses." Has this provision been found ample for the purpose? Would it not be desirable to insist on an entirely independent source, such as a storage battery?—J. H. R., Pittsburgh, Pa.

The Cleveland city code provides that in addition to the usual emergency lighting, there shall also be a storage-battery auxiliary lighting system. This battery must be of sufficient capacity and lamps so arranged as to light the house for 15 minutes. The amount of light demanded is such that the house may be easily emptied without confusion. This requirement has been of very great service in several cases which have come to the writer's personal attention.

In one instance, after motion-picture exhibitor had objected very strenuously to the installation of this equipment, and after it was necessary to threaten him with closing his theater, he finally installed it. The next week, the power supply failed for 15 to 20 minutes, and the exhibitor was thankful that he had installed this additional equipment, for the reason that he was able to light his theater and so hold the house in control.—E. W. P. S., Cleveland, O.

No. 345.—Demagnetizing Iron Castings.—How can magnetized iron and steel castings be readily demagnetized? We are experiencing a great deal of trouble with castings that have been magnetized by the lifting magnet in the foundry yard. When these castings are being machined, it is impossible to get the true size, inside or outside diameter, because of the magnetic attraction on the calipers. Some of our work is large and some quite small. An alternating-current demagnetizing coil would have to be too large and costly to be practicable. Is there no cheaper or easier way to demagnetize these castings?—J. B. K., Torrance, Cal.

The best means for demagnetizing iron and steel castings is annealing, by heating the castings up to the point of a dark red which can just be seen in daylight. This would demagnetize entirely. The parts, of course, must not be handled afterwards again by the lifting magnet. This in all probability is done only when the castings come from the foundry in great quantities, afterwards they will doubtless be handled individually, and lifted by hand or by small cranes. As a foundry is already on the ground, this proposition would very likely be the most economical, a little furnace being easily installed for the annealing. This will be much cheaper and more effective than demagnetizing by alternating current, in which case also provision must be made for gradually diminishing the strength of the initial current to zero before breaking.—H. A., Pittsburgh, Pa.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

Wirt Dimming Sockets.

Through the development of dimming sockets an additional impetus is being given to electric lighting, particularly in residence service. Ceiling fixtures, wall brackets and portable lamps can now be supplied with sockets which enable the consumer to obtain every advantage of electric lighting together with ability to regulate the amount of light by a small dimming arrangement. Thus, such dimming sockets enable the light to be turned up or down as readily as with a gas lamp and, therefore, meet the only advantage which gas lighting has heretofore possessed over electric lighting.

The first compact and self-contained dimming socket was

Two Types of Dimming Sockets, the First Including a Shade Holder.

described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 5, 1914. This socket was the development of the well known Dimalite device. Since that time the Wirt Company, Armat and Lena Streets, Philadelphia, Pa., has further developed its line of dimming sockets and now has a number of improved types available. These are shown in the accompanying illustrations. Each of them gives five changes of light,

Use of Dimming Sockets for Bracket and Portable Lamps.

namely, full, half, dim, night light, and out. They are controlled by a convenient double chain, of which one portion has the ordinary ball end and the other has a tubular part through which the former passes. One of these chains is used for increasing the light step by step and the other is used for turning it down. Included in the socket is a very compact and durable resistance, which is introduced in series with the lamp when the light is turned down, thus effecting a saving in the current of from 30 to 80 per cent, depending upon the degree of dimming. These sockets, of course, can be used for any type of Edison base lamp and are designed to be attached permanently to the fixtures with thread and set screw, the same way as ordinary sockets are attached.

One of these sockets (No. 31) is supplied with 2.25-inch holder and is intended for use on lighting fixtures in hallways, bathrooms, bedrooms, nursery, etc. Another socket (No. 32) is designed especially for use in portable, table, piano, and floor lamps, special brackets, etc. Both these sockets may be used on any fixture where direct control of light is desired. Their use dispenses with the need for the ordinary pull-chain or key socket with an additional dimming device. In addition to convenience and economy these sockets lend themselves to very artistic effects when installed on ornamental fixtures.

Ward Leonard Adaptor Resistance Units.

Occasion frequently arises for inserting in series with a circuit a certain amount of resistance. A very convenient means for doing this has been developed by the Ward Leonard Electric Company, Bronxville, N. Y., through its new Adaptor resistance units. These consist of enameled resistances mounted with an Edison base screw plug at one end and an Edison socket at the other end. Thus this unit provides a very convenient means of connecting the resistance in series with the circuit, since it can be interposed between the connecting cord and any portable device. These resistance units can be furnished for practically any resistance and current-carrying capacity desired. They are used extensively to enable universal type

Adaptor Resistance Unit for Series Connection to Circuit.

motors to be used either on alternating-current or direct-current circuits so as to give identically the same speed, which means that a resistance should be used on the direct-current circuit. These resistances have also been used in connection with low-voltage apparatus when connected to circuits of higher voltage.

The resistance unit consists of a porcelain tube having resistance wire with low temperature co-efficient wound on it; the joint between the resistance wire and terminal lead is made while the parts are bright and clean and under high pressure, thus insuring a perfect connection through life. The entire resistance winding, as well as this joint, is imbedded in a coating of vitreous enamel which thoroughly protects it from electrical, chemical and mechanical disintegration.

Mazda Spot or Lens Light.

The prophesied passing of the hand-fed arc-lamp device used for stage purposes and portable illumination appears to have been at last realized. Last year the Sprague Works of the General Electric Company, New York City, placed on the market an Olivette type of device used as a flood lamp for illuminating large surfaces which rapidly

Sprague Mazda Spot Light.

supplanted the hand-fed arc type of device used for the same purpose and now this company is in the field with a lens lamp or as it is sometimes termed spot lamp, which undoubtedly will be welcomed by the trade as a successor to the hand-fed arc device.

This device, using the Mazda gas-filled lamp as its illuminant, is designed to take the place of the hand-fed arc lamp at present used for projecting purposes in theaters, assembly halls and motion-picture houses generally. It can be used for any purpose for which the present arc device is now employed, namely, as a flood light from the balcony or gallery, or as a spot light from the same location.

The hood of the device is substantially constructed and of neat appearance. A special feature has been made of the design of this ventilating hood to produce a device that will meet the requirements of the National Board of Underwriters. No part of the exposed surface of this hood attains greater temperature than 200 degrees Fahrenheit while in continuous operation. The hood is built with an inner and outer body, thus permitting a clear circulation of air to pass around the lamp at all times.

The hood is mounted on a telescopic stand which permits it to be raised or lowered at will, while a swing-joint attachment permits operation of the light in any direction.

New Double-Contact Push Button.

A new type of push button has recently been placed upon the market by the Connecticut Telephone & Electric Company, Meriden, Conn. This button is fitted with long self-cleaning contact springs which have a double wipe. This is the only push button upon the market with a double rubbing contact. The contacts are protected by a heavy metal guard, and lugs on the side of binding-post screws keep the wire connections in position, therefore no soldering is necessary.

Double-Contact Button.

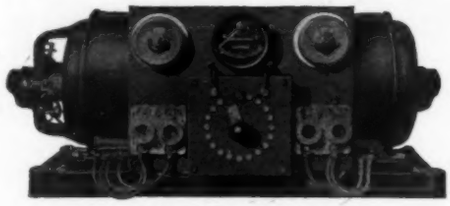
The push button has a large oval center which has a solid stop. The entire button is solidly built and is practically indestructible. This button is arranged to be mounted singly or in groups and designed to fit a five-eighths-inch hole. It can be furnished with black, white or pearl center, as desired.

Motor-Generator Equipment for Charging Small Storage Batteries.

Every garage operator and automobile owner has experienced the need of a convenient means for charging small storage batteries, such as are used today on practically all up-to-date gasoline cars for starting, lighting and ignition service. Launch owners also have experienced the same need.

For economically charging these small storage batteries, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is marketing an equipment shown in the illustration. This simple, compact motor-generator can be connected to the most commonly found lighting circuits, namely 110 or 220-volt, 60-cycle, alternating current or 115 or 230-volt direct current. The motor-generator takes its power from the line and generates direct current at a voltage slightly higher than that of the battery.

The panel and the charging set are supplied completely wired ready for operation, which is extremely simple. The motor is first connected to the supply circuit and then started by means of a snap switch. The battery is connected to the generator terminals and the charge rate adjusted by means of the field rheostat to the value shown on the battery name plate. The charging is continued according to the method recommended by the battery manufacturer. As the generator is shunt wound, its voltage increases as the ampere load decreases. That is, as the battery approaches a charged condition the potential of the generator automatically rises to the higher value required for finishing the charge. This voltage characteristic is a great advantage where lead batteries are to be charged, because it permits the operator to give the battery an equalizing or long-period low-rate charge which prolongs the battery life.



Battery-Charging Motor-Generator.

The Westinghouse charging equipment includes a motor-generator and a charging panel with the necessary controlling rheostat, ammeter, switches and fuses. Snap switches and fuses control both the motor and generator, conforming to all the requirements of the National Electrical Code. The outfit is simple and compact; it is easily installed and operated.

Improved Alternating-Current Cooper Hewitt Lamps.

During the last few months a marked improvement has been made by the Cooper Hewitt Electric Company, Hoboken, N. J., in its type F or alternating-current mercury-vapor lamps. Formerly it was impossible to design these lamps so as to have a power-factor much over 50 per cent. Through a redesign and improved construction of the lamp auxiliaries, the power-factor of these units has now been raised to about 87 per cent. These lamps have also been found to operate very satisfactorily on 25-cycle circuits; they are very steady in operation and provide a non-fluctuating light at this low frequency. These Cooper Hewitt lamps are made in two lengths, 20.75 and 50-inch tubes. They are made for various frequencies from 25 to 133 cycles.

Brassart Lighting Fixtures.

The problems of the fixture designer and manufacturer are becoming more complicated every day on account of the continued demand for artistic and original designs which may be produced at moderate cost. One of the fixture firms that is making conspicuous headway in this direction is the Brassart Fixture Company, 13-15 Laight Street, New York, N. Y. This company is making a very complete line of electric, combination and gas fixtures, to which new designs are being added from time to time. To give an adequate idea of these fixtures is impossible in the limited space available. Therefore, only a few typical designs picked at random are illustrated herewith.

Fig. 1 is a semi-indirect fixture with very attractive glassware of the Adam period of design. This glass is an excellent diffuser and makes the embossed design stand out in very pleasing relief. The length of this fixture is 36 inches, its spread 18 inches and the diameter of the bowl is 16 inches. The metal parts are of polished brass or special finish.

Figs. 2 and 3 are two designs of the Greek period, which were modeled and patented by the firm. The shades of the pendent lamps are artistically etched. The candle-type fixture has silk shades and is in harmony with the popular vogue of the day. These fixtures have met an immediate demand and have proven an excellent sales proposition. The length and spread of the fixture shown in Fig. 2 are 36 and 18 inches, respectively, while those of the fixture shown in Fig. 3 are 42 and 17 inches. These fixtures may be had for different numbers of lamps.

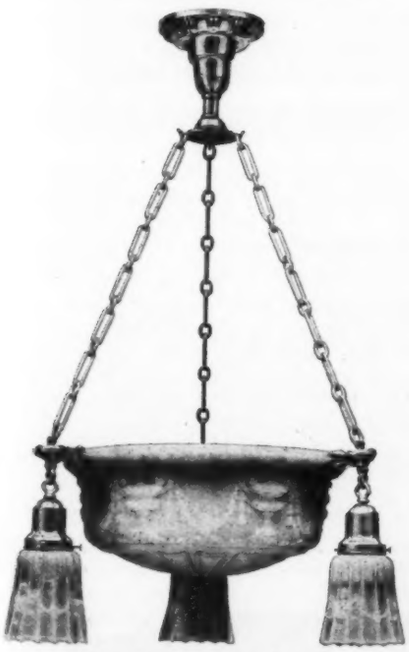


Fig. 1.—Semi-Indirect Fixture.

Fig. 2.—Four-Light Fixture of Greek Period.

Fig. 3.—Four-Light Candle Fixtures.

The Ko-Shovel Stoking Machine for Boiler Furnaces.

Power-plant engineers have for many years recognized the great value of mechanical stoking, the principal advantages of which are greatly improved economy in fuel consumption and reduced labor costs. A considerable number of mechanical stokers are now on the market but, as a rule, their installation has been rather costly and involved other difficulties which have retarded their use in the smaller plants, at least.

A new design of stoker has recently been developed which, on account of its great simplicity of construction, overcomes the difficulty of high installation cost and has the further advantage that it can be applied to any existing boiler front without difficulty. This device, known as the "Ko-Shovel," can be installed either in the upper portion of the fire-door opening or immediately above the door in the boiler front. The horizontal chute and plunger arrangement which connects with the interior of the furnace requires a vertical depth of only five inches and, if installed in the fire-door opening, requires merely the replacement of the fire door by a new and shallower door. The general method of installation can be seen from the view in Fig. 1, on Page 778.

The coal is spouted from overhead bins or shoveled by hand into single or double hoppers which have sufficient capacity to run the boiler for about one hour. At the base of this hopper is a compact coal crusher which breaks up the larger lumps to a size suitable for firing. From the crushing rolls, which also act as agitators, the coal passes to a rotating valve in the bottom of the crushing compartment. This valve supplies small charges of coal to a chamber directly above the reciprocating piston. This piston is attached to a crosshead or a carriage which is mounted on ball-bearing rollers. Connected to the carriage are powerful tension springs which, through a special cam arrangement, are alternately placed under tension and then suddenly released, driving the piston with its charge of coal forward at frequent and definite intervals. As the piston moves forward with considerable velocity it projects the charge of coal in front of it and over a water-cooled deflecting plate that causes it to spread evenly over the entire grate surface, thus corresponding to an ideal automatic fireman. The general arrangement and operation of the stoker can be seen from the sectional view.

In general principle the Ko-Shovel stoker approaches very closely to the practice of feeding powdered fuel, which has been found to give under proper conditions the most perfect form of furnace combustion. Therefore coal is burned in the combustion zone before it actually touches the fuel on the grate. The charge of coal is about one-half pound and this is fed at intervals averaging about four seconds. The rate of feed is varied either automatically

Fig. 1.—Ko-Shovel Stoker Applied to Return Tubular Boiler.

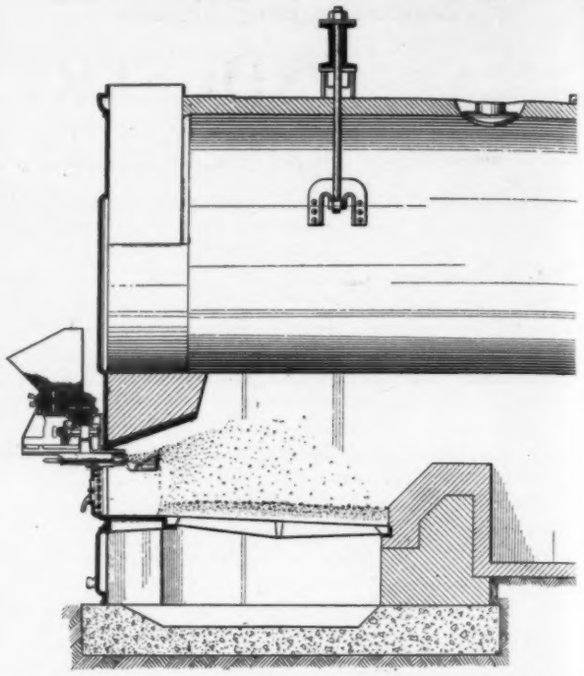


Fig. 2.—Section Through Boiler Furnace and Ko-Shovel, Showing Operation of Latter.

or by hand in accordance with the demand for steam. The equipment is of simple design and very ruggedly built. Its weight complete is about 400 pounds. For attaching the entire stoker mechanism, including the hopper, to the boiler front requires only four five-eighths-inch bolts.

One of the marked advantages claimed for this stoker is that its operation can be intrusted to the ordinary fireman. It does not interfere with hand firing and, in fact, can be used along with hand firing, if the necessity for this should ever arise. It lessens the work of the fireman because, if no overhead bins are used, he needs merely to fill the hoppers about every one-half to one hour. The hand cleaning of the fires can be taken care of through the fire door as usual. Any grade of coal from 1.5-inch bar screenings to No. 5 washed or unwashed coal can be used.

These stoking machines can be used on return tubular as well as water tube boilers. Their use insures proper feeding of the coal in steady and small quantities which have been conclusively shown to give maximum economy and smokeless operation. Since the fire door is not opened, except for occasional cleaning of the fires, no cold air is admitted to chill the furnace. These stokers can be operated by means of a steam engine or electric motor.

The Ko-Shovel is manufactured by the Goetz Company and sold exclusively through George A. Kohout & Company, Monadnock Block, Chicago, Ill.

Eight Cars of Electric Ranges.

It has been estimated that at least $1,000,000 worth of electric ranges will be sold during 1916. The increased activities of the electric-range manufacturers is an indication that this desirable goal will be attained. The largest single order ever placed for electric ranges was recently filled by the Pittsfied, Mass., works of the General Electric Company for shipment to the Salt Lake district. The shipment contained 90 apartment-type ranges, 105 type S-3 ranges for domestic use, and 416 ranges of assorted types. This is a total of 611 ranges, with a listed value of approximately $53,000 and filling eight cars when packed for shipment. The demand for electric ranges in the Salt Lake district indicates the rapid growth of electric cooking in that section. Indeed, this movement to completely electrify the kitchen is becoming common throughout the country where special low cooking rates are being established, placing electricity on an equal footing with gas and coal, so far as cost is concerned.

INDUSTRY ACTIVITIES

Harvey Hubbell, Incorporated, Bridgeport, Conn., has prepared a mailing folder illustrating the service of Hubbell T-slot receptacles and attachment plugs.

The Electric Agencies Company announce its removal on May 1 to 419 East Third Street, Los Angeles, Cal., where the company will maintain offices and warehouse.

Beardslee Chandelier Manufacturing Company, Chicago, Ill., has established a branch office in San Francisco, Cal., under the direction of E. C. Weber and L. N. Scammon, both very well known to the Pacific Coast trade.

The Hughes Electric Heating Company, Chicago, Ill., added 5,000 square feet of floor space to their factory last week. The company recently was awarded the contract for the bake-oven equipment of the new Edgewater Beach Hotel, Chicago.

The E. C. Cowie Electrical Company, of Kansas City, Mo., is making plans to open a branch house in Wichita, Kans., about June 1. The company manufactures a self-starter for automobiles and specializes in storage-battery and charging equipment.

The Adams-Bagnall Electric Company, Cleveland, O., has issued a folder which gives views of some of its single and three-phase transformers, low and high-voltage distributing and power transformers and constant-current regulating transformers for street-lighting work.

The Independent Electric Company, El Paso, Tex., jobber and dealer in electrical supplies and electrical contractor and engineer, occupied prominent space in a publication called *Commerce of El Paso,* which gave a comprehensive survey of the advantages of that city as a commercial center.

Dielectric Manufacturing Company, St. Louis, Mo., has issued a handy 48-page booklet entitled "Data on Dependable Insulation." It contains valuable metric conversion factors and other data, characteristic curves of various insulating materials, and brief descriptions of the properties of the company's numerous insulating mica products, varnishes, paints and other compounds.

The Domestic Engineering Company, of Dayton, O., recently incorporated to take over the manufacture of the "Delco" farm-lighting system, shipped its first machine a few days ago. A number of the outfits had previously been manufactured for experimental purposes, but the first machine for actual use was completed only a short time ago. The plant is now ready, however, to proceed to business on a large scale, and orders already on hand are reported to be so numerous as to make a considerable degree of activity a certainty.

The Roller-Smith Company, 203 Broadway, New York City, announces that it has added to its list of agents the Barber-James-Dwinnell Electric & Manufacturing Company, 600 East Fifteenth Street, Kansas City, Mo., who will handle the former company's instruments, meters and circuit-breakers in the territory comprising the states of Kansas, Oklahoma, Nebraska, Iowa and part of the state of Missouri. The Roller-Smith Company now has branch offices in the Monadnock Block, Chicago, Ill., and the Williamson Building, Cleveland, O. Its complete list of agents, other than the ones referred to above, is as follows: Conant Electric Company, Equitable Building, Baltimore, Md.; W. W. Geisse, First National-Soo Line Building, Minneapolis, Minn.; H. D. Lackore, 544 Henry Building, Seattle, Wash.; H. I. Shire, 1310 Majestic Building, Detroit, Mich.; Tompkins-Stoddard Company, 77 Franklin Street, Boston, Mass.

The Electric Fuse Guard Company, Newark, N. J., has acquired property at 60 Shipman Street, and will establish a plant for the manufacture of fuse guards and other electrical specialties.

General Electric Company transformer specialists from various parts of the country held a conference at Pittsfield, Mass., April 11-13, this being the first meeting since 1914. Daily sessions were held, M. O. Troy, sales manager of the Pittsfield works, presiding over these and a banquet held the last evening of the conference.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Leaflet 3838, on No. 557-A railway motors; Leaflet 3852, on type E B alternating-current switchboards, arranged for hand operation of oil circuit-breakers; Leaflet 3886, on Westinghouse-American Blower generating sets for direct current.

The Borden Company, Warren, O., manufacturers of pipe and thread-cutting tools, has prepared reprints of an article on "The Evolution of Hand Pipe-Cutting Tools," by W. A. Phillis, which appeared in the *Plumbers Trade Journal* March 1, 1916. The evolution is described from the year 1800 to the present date and points are brought out showing why users of pipe and electric conduit should use efficient cutting tools. The reprints are being distributed free by the company.

Betts & Betts, 256 West Fifty-fifth Street, New York City, are building a 20-foot, self-winding "Electric Klok" for the new Circle Theater in Indianapolis, Ind. The installation is being made by the Sanborn Electric Company, of that city, which also has the complete electrical contract. In addition to the "Klok," which will have electric hands, numerals and minute marks, there will be an attractive electric sign, which will be equipped with a Betts & Betts special flasher and several hundred color caps. This will be one of the most elaborate electrical displays in that part of the country. Other "Klok" installations being made this month are in Syracuse, N. Y. Providence, R. I.; Boston, Mass., and Lancaster, Pa.

Deuth & Company, Incorporated.—In order to widen the scope of its incandescent lamp business, Deuth & Company has found it necessary to completely reorganize and secure additional capital. The company has reorganized as Deuth & Company, Incorporated, with Eugene J. Deuth, formerly president of the old company, president, and W. Dunbar McElhinny secretary and treasurer. The other directors of the new company are George H. Dirkes and Charles LeBarbier. Deuth & Company, Incorporated, has gone into the manufacture and import of incandescent lamps on a very large scale and in addition to its own business has secured the output of two of the largest lamp factories in the country. The main offices and salesrooms occupy the entire eleventh floor of the Fifth National Bank Building, 131 East Twenty-third Street, New York City, and the company is establishing agencies throughout the United States. For the convenience of its New York City trade, it maintains two large warehouses in that city, in which it maintains a minimum stock of 200,000 lamps. It also has a number of supply stations in other cities in which it carries large stocks. At the last meeting of the Board of Directors, it was decided that the new company should carry on a large amount of experimental work in the lamp field. A corps of experts have been assembled and this work is going forward with gratifying results. The sales force is under the supervision of F. R. May, assisted by Thomas Magiff. At the present time the company has about 20 salesmen in New York City and surrounding territory.

LATEST APPROVED FITTINGS

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association

CONDUIT BOXES.—The Adapti Manufacturing Company, 919-25 West Street, Cleveland, O.

Pressed steel and cast-iron conduit boxes.

For use with rigid conduit, catalog Nos. 7110-12, 7220-22, 7234-35, 7245, 7260-62, 7270-72, 7330-32, 7440-42, 70290-92, 72350-52, 72370-72, 72380-82, 73343-45, 73353, 73390-92, 73443, 73445, 73454, 73535, 73545, 73553-54, 74490-92, 743334-35, 743344-45, 743355, 743434, 743444-45, 743455, 743535, 743555, 744445, 744455, 744545, 744555.

Listed March 10, 1916.

EGG TESTER.—Lo-Glo Electric Incubator Company, Incorporated, 76 Greenwich Street, New York, N. Y.

Egg tester consisting of an incandescent lamp in a sheet-metal casing having an oval opening over which the egg is placed, and having a reinforced portable cord and attachment plug for connection to ordinary lighting circuit. Lo-Glo; 60 watts, maximum volts, 250.

Listed March 9, 1916.

FIXTURE FITTINGS.—National Specialty Manufacturing Company, Lehigh Avenue, American and Third Streets, Philadelphia, Pa.

Gray-iron bodies, eccentrics, tripods and crow feet, catalog Nos. 0165-69, 0196, 0199, 0200, 0210, 0219-20, 0225, 0285-95, 0287½, 0293½, 0297-00, 0298½, 0303-06, 0304½, 0304¾, 0309-14, 0311½.

Malleable-iron crow feet, finishers, saddles and hickeys, catalog Nos. 0271-79, 0276½, 0280A-G, 0350-53. 0432-35, 0511-24.

Listed February 5, 1916.

GROUND CLAMPS. — The Cap Swivel-Let Company, Warren, R. I.

Grounding lock nuts consisting of copper-plated malleable iron or cast brass lock nuts for rigid iron conduit, each nut formed with a soldering lug for receiving a ground wire. Johnson. For ½, ¾ and 1-inch rigid iron conduit.

Listed March 9, 1916.

INSULATING SUPPORTS. — The Thomas Wrigley Company, 416 South Dearborn Street, Chicago, Ill.

Consisting of two pairs of stamped steel hooks, joined by connecting strap, for use in mounting porcelain cleat on steel girder. Ahlander girder clamp. Styles A and B.

Listed March 9, 1916.

PANELBOARDS.—Chicago Switchboard Manufacturing Company, 428 South Clinton Street, Chicago, Ill.

Panelboards shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Listed March 7, 1916.

SWITCHES, Automatic.—Automatic Switch Company, 4-6 White Street, New York, N. Y.

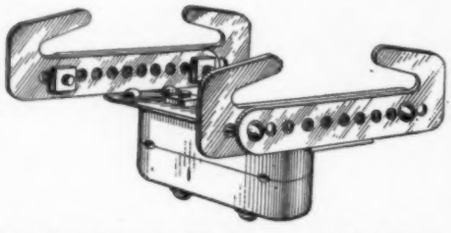
Magnetic switches, remote-control switches of special design mounted on slate bases and arranged to be operated by push-button switches, thermostats, pressure-regulating switches and similar controlling devices at remote points. Darrin, 20, 75 amperes, 250 volts, alternating or direct current. Type DMS.

Listed March 9, 1916.

SWITCHES, Enclosed.—The Johns-Pratt Company, Hartford, Conn. The H. W. Johns-Manville Company, New York, N. Y., sole agents.

"Noark Universal," 30 amperes, 250 volts.

Two, three or four-pole switches with specual cutout bases for plug or cartridge fuses, also two-pole, 30-ampere, 125-volt switches with special cutout



Insulator Support.—The Thomas Wrigley Company.

bases for link fuses. Inclosed in metal case and designed for manual operation without opening cases, for service entrance or other uses. These switches may consist of suitably chosen parts, and may be fitted with accessories for meter testing, etc.

The appliances which comprise this so-called system may be made up from the following unit parts:

Noark Universal System. Base block units, catalog Nos. 10121, 10102, 10116.

Connectors, unfused, for cartridge, plug and link fuses.

Branch tap straps, catalog Nos. 10270-72.

Sealable cabinets, catalog Nos. 10200-10201.

Meter adapters, catalog Nos. 10400-14.

Load side device supports, catalog No. 10225.

Troughs for cabinets, catalog Nos. 10310-15.

External switch handles, catalog Nos. 10235-38.

Direct switch handles, catalog Nos. 10251-42.

Current transformer testing device. A special form of switch gear for use in testing current transformer meters. With or without fuses or enclosing cabinets.

Also special meter test plugs and cords.

Listed February 17 and 18, 1916.

SWITCHES, Fixtures.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Single-pole, 3 amperes, 250 volts, 6 amperes, 125 volts; catalog Nos. 7306, 7307, 7309, 7311.

Listed March 2, 1916.

SWITCHES, Knife.—Albert & J. M. Anderson Manufacturing Company, Boston, Mass.

Anderson, types A, all capacities, 250 volts.

Listed March 8, 1916.

SWITCHES, Surface Snap.—Trumbull Electric Manufacturing Company, Plainville, Conn.

Single-pole, 3 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 404, 405.

Listed March 2, 1916.

WIRES, Miscellaneous.—D. & W. Fuse Company, Providence, R. I.

Deltabeston motion-picture-machine cable.

Standard conductors, Nos. 14 to No. 1 B. & S. gauge with a felted asbestos insulation covered by an outer braid of asbestos, impregnated with a moisture-proofing compound.

Standard for use in wiring moving picture machines, projectors, rheostats and similar devices where heat-resisting properties are required.

Listed March 8, 1916.

WIRES, Miscellaneous.—D. & W. Fuse Company, Providence, R. I.

Deltabeston switchboard wire.

Solid conductors of all standard sizes, insulated by a felted asbestos covering treated with a brown insulating filler and covered by an outer braid of black or white asbestos.

Standard for use on back of switchboards in circuits not exceeding 600 volts.

Listed March 9, 1916.

WIRES, Rubber-Covered. — Kerite Insulated Wire & Cable Company, 30 Church Street, New York, N. Y.

Marking: Green and black threads parallel in braid; or in lead encased or steel armored conductors without braids or wires having colored braids; green, white and black threads parallel with wire between insulation and outside finish.

Listed February 17, 1916.

PERSONAL AND BIOGRAPHICAL

MR. ARTHUR W. BERRESFORD, vice-president and general manager of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., who was selected as the Wisconsin representative of the American Institute of Electrical Engineers on the Industrial Preparedness Committee of the Naval Consulting Board, was born in Brooklyn, N. Y., in 1872. He was graduated from the Brooklyn Polytechnic Institute in 1892 and from Cornell University in 1893, receiving the degree of mechanical engineer in electricity from the latter institution. Following his graduation Mr. Berresford engaged in general work for several public service companies, then became a designer in the employ of the Riker Electric Company and in 1896 was placed in charge of the testing and designing work of the Ward Leonard Electric Company. Two years later, in company with other interests, he purchased the holdings of the Iron Clad Rheostat

A. W. Berresford.

Company and formed the Iron Clad Resistance Company, becoming vice-president and manager of that company. In 1900 the Cutler-Hammer Manufacturing Company purchased the Iron Clad company and Mr. Berresford entered the engineering department of the former company, becoming superintendent in 1901, secretary in 1902, general manager in 1905, and assuming his present position in 1907. Mr. Berresford is a fellow of the American Institute of Electrical Engineers and was a member of its board of managers 1909-12, and vice-president from 1912 to 1914. He is also a member of the National Electric Light Association, the American Society of Mechanical Engineers, the Society of Naval Architects and Marine Engineers, Franklin Institute, Society for the Promotion of Engineering Education, Electrical Manufacturers' Club and other organizations.

MR. F. E. M'KENNA, local manager of the Oregon Power Company at Coquille, Ore., has been elected secretary and treasurer of the Ko Keel Klub.

MR. NOAH KENNARD has been appointed manager of the municipal electric-lighting plant at Morehead, Ky., succeeding MR. E. E. MAGGARD, who resigned to enter business for himself.

MR. W. H. THOMSON, JR., general manager of the Des Moines (Iowa) Electric Company, will become general manager of the Kansas City (Mo.) Light & Power Company. The change will become effective on or before June 1.

MR. J. W. WORTHINGTON, who has been vice-president of the Alabama Power Company, has resigned. He has been elected president of the Muscle Shoals Hydro-Electric Power Company, a subsidiary of the Alabama Traction, Light & Power Company.

MR. CHARLES R. UNDERHILL, chief electrical engineer of the Acme Wire Company, New Haven, Conn., lectured on the subject of "Electromagnets" at Leland Stanford University, Palo Alto, Cal., April 17, and at the University of California, Berkeley, Cal., April 18.

MR. WILLIAM WEISSENBERGER, JR., who is retiring, after sixteen years' service as architect for the New York Edison Company, was tendered a testimonial dinner Monday evening, April 17, at the Biltmore by the officials and his friends in the company. Mr. Weissenberger is retiring to enter business for himself.

MR. JAMES CLARK, JR., president of the James Clark, Jr., Electric Company, Louisville, Ky., has modestly called our attention to an error which appeared in our last issue relative to his being appointed a colonel on Governor Stanley's staff. Mr. Clark advises that this appointment was made to MR. JAMES S. CLARK, of Louisville.

MR. CLYDE A. FLINT recently has entered the employ of Rathbone, Sard & Company, of Albany, N. Y., and Aurora, Ill., and will sell in the territory east of the Mississippi River the line of electric ranges which that company has put on the market. Mr. Flint was connected with the Simplex Electric Heating Company for five years and with Duparquet, Huot & Moneuse until recently. He enjoys a wide acquaintanceship in the electrical trade.

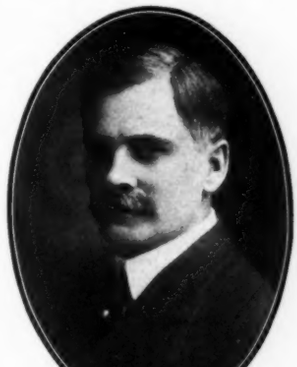
DR. WILLIS R. WHITNEY, director of the research laboratories of the General Electric Company, Schenectady, N. Y., has been awarded the Willard Gibbs medal, founded by William A. Converse, of Chicago. The presentation will be made May 19, in connection with the meeting of the Chicago Section of the American Chemical Society, when Dr. Whitney will make an address on "Incidents of Applied Research."

MR. W. H. WOOD has been appointed superintendent of power plants of the Baltimore & Ohio Railroad, with headquarters at Baltimore, Md., succeeding MR. T. F. FOLTZ, resigned. Mr. Wood formerly had charge of the boiler plants of the American Writing Paper Company, of Holyoke, Mass. He was born in 1875, and graduated from the University of Arts and Sciences in 1898, following which he was connected with the Standard Steel Company, Burnham, Pa. From 1889 to 1914 he was associated with A. C. Wood, a consulting engineer.

MR. JOHN J. MILEY, formerly purchasing agent of the Minneapolis (Minn.) General Electric Company, is now with the Mississippi River Power Company, Keokuk, Iowa.

MR. H. O. SWOBODA, consulting electrical and mechanical engineer, Pittsburgh, Pa., has been retained by the borough of New Brighton, Pa., for the purpose of planning a new street-lighting system for that borough.

MR. BION J. ARNOLD, the well known consulting engineer, and chairman of the Board of Supervising Engineers, Chicago Traction, has been selected by Secretary of Navy Daniels to be a member of the Naval Consulting Board. He will be the representative of the American Aeronautical Society. Besides his manifold activities in consulting engineering and his services on the new special traction investigating commission in Chicago, Mr. Arnold has taken deep interest in



B. J. Arnold.

questions of national defense. A hobby of his has been aeronautics, to which he has devoted much time, thought and resources. Mr. Arnold has always been a most active and progressive man throughout his engineering career of about 25 years. He is a past president of the American Institute of Electrical Engineers and the Western Society of Engineers.

MR. C. G. CHILDERS, formerly manager of the new-business department of the Gadsden, Alabama City & Attalia Street Railway Company, has resigned to become special representative of the general and operating managers of the Alabama Power Company, Birmingham.

OBITUARY.

MR. WILLIAM A. HOPKINS, president of the Erner & Hopkins Company, Columbus, O., one of the largest electrical jobbers and contractors in Ohio, died in Columbus, April 22, aged 42 years, from the effects of a tumor. A native of Henderson, Ky., he came to Columbus in 1898, and was employed by the local street railway company, a few years later helping to organize the concern which bears his name. Mr. Hopkins was very popular in the electric trade. He was unmarried.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

MARS HILL, ME.—The Westfield Electric Company has been authorized to own and operate an electric plant to supply this locality. The capital is $10,000, and the president is R. J. Colbath, Mars Hill, Maine.

SEBEC, ME.—The Milo Electric Light & Power Company has been authorized by the Public Utilities Commission to enter this town and supply electricity for light, heat and power. A 6,600-volt, two-phase transmission line will be constructed.

MANCHESTER, N. H.—Improvements and construction work, estimated to cost $788,000, undertaken by the Manchester Traction, Light & Power Company during last year, are rapidly being completed. The building operations for a new steam plant at Kelley's Falls have been finished, and the electrical machinery is expected to be installed so that plant will be ready for service in June. The new substation at the same place will be ready at that time. A high-tension transmission line from the Kelley's Falls plant to the one at Garvin's Falls has been erected. The new substation at the latter plant is ready for occupancy, but some new switchboard equipment will be installed during the summer. Electrical equipment for the Brooks Street substation in this city has not yet been fully installed, but it is expected it will be completed in July.

MALDEN, MASS.—The City Council has passed an order appropriating $500 for the employment of an electrical expert to investigate the city lighting system.

WALTHAM, MASS.—City officials and the Edison Electric Illuminating Company of Boston, which serves this community, are considering improvements in the city lighting system

WYBEN, MASS.—The Westfield (Mass.) Gas & Electric Light Works is making plans to extend its transmission lines to furnish electric service here. Power will also be furnished to the plant of the Westfield Clay Products Company near here.

NEW LONDON, CONN.—The exterior work on the new power house being erected by the Shore Line Electric Railway in Williams Street has been completed. A pole line from the power house to the Cohanzie road has also been completed.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has received permission from the Public Service Commission to issue bonds and preferred stock to the amount of $1,000,000. Part of the proceeds will be used for plant enlargements and betterments. A new 3,500-kilowatt turbogenerator with necessary auxiliaries, estimated to cost $77,000, will be installed.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has placed an order with the Westinghouse Electric & Manufacturing Company for a 30,000-kilowatt turbogenerator for its Williamsburg station. The unit will run at 1,500 revolutions per minute and use steam at 200 pounds pressure and 115 degrees superheat, exhausting into a 28.5-inch vacuum produced by a 40,000-square-foot Westinghouse surface condenser.

FULTON, N. Y.—The Public Service Commission, Second District, has granted permission to the Fulton Light, Heat & Power Company, to issue $49,000 worth of six-per-cent preferred stock for improvements and extensions to its plant. It is the company's intention to expend most of the money thus obtained on the distribution system, although considerable money will be spent on improving the power plant.

POTSDAM, N. Y.—The St. Lawrence Transmission Company, which recently was combined with the Northern Power Company, will complete this season the construction of a transmission line from Raymondville to Massena, connecting with a line built last year from Hanawa to Raymondville. The lines connect developments at Higley and Hanawa with those at Massena and Cedar Rapids, on the St. Lawrence. The length of line to be constructed is 25 miles. Steel towers and aluminum cable will be used.

SCHENECTADY, N. Y.—The Schenectady Illuminating Company has begun the construction of standards for the ornamental incandescent lighting system to be placed in the avenues between Eastern Avenue and Central Park. Concrete standards similar to those on the boulevards are being built.

WHITESTONE, N. Y. (Flushing Postoffice).—The Whitestone Improvement Association has asked the Department of Electricity for the installation of a number of lamps on Ninth Street.

BAYONNE, N. J.—The Board of City Commissioners has instructed City Engineer Clarkson to secure estimates of cost for the installation of an underground conduit system throughout the city.

MORRISTOWN, N. J. — The Morris County Traction Company will install new equipment, including transformers, at its Dover power station.

JERSEY CITY, N. J.—The Grove Street Merchants' Association is negotiating with the City Commissioners for the installation of a new street-lighting system along Grove Street.

HALIFAX, PA.—Application will be made May 1 for a charter for incorporation of the Halifax Electric Light, Heat & Power Company, which intends to supply service here. H. L. Lark is the solicitor.

POTTSVILLE, PA.—The Eastern Pennsylvania Light, Heat & Power Company, with headquarters in Pottsville, has purchased the electric-lighting plants of the boroughs of Auburn and Pine Grove and is preparing to supply energy to those towns from its central power house at Palo Alto.

VARDEN, PA.—Application has been made for a charter for the Varden & Lake Ariel Electric Light, Heat & Power Company by A. F. Kizer, W. W. Kizer and others. The company plans to furnish electric service in the vicinity of Varden and Lake Ariel.

WILMINGTON, DEL.—The Lykens Valley Light & Power Company has been incorporated here with a capital of $600,000 to acquire and operate public-service corporations by H. E. Latter, N. P. Coffin and others.

RALEIGH, N. C.—Preliminary work for the installation of the white way on Martin and Fayetteville Streets has commenced. The Carolina Power & Light Company and the telephone companies are placing their wires underground in the white-way district.

SALUDA, N. C.—The Saluda Public Service Corporation has been incorporated with a capital of $25,000 by T. D. Fulmer and E. W. Able to build and operate an electric-lighting plant here.

MANNING, S. C.—Fire in boiler room of the Manning Electric Light Plant did considerable damage to the plant.

DEFUNIAK SPRINGS, FLA.—An election will be held May 2 to vote on the question of issuing $45,000 municipal improvement bonds, of which it is proposed to use $5,000 for enlarging the electric-lighting system.

MIAMI, FLA.—The Miami Traction Company is planning to make line extensions. B. B. Tatum is president of the company.

PENSACOLA, FLA.—Bids will be advertised for lighting the streets of Pensacola for the ensuing year. The new lighting contract is expected to be made effective June 1.

NORTH CENTRAL STATES.

CINCINNATI, O.—C. W. Handman, business manager of the Board of Education, is calling for bids on the work of remodeling the Whittier school, including the electrical work. Plans and specifications are in the hands of the Board. Bids will be opened at noon on May 22.

CINCINNATI, O.—The Union Boulevard Lighting Committees, consisting of a number of local civic and business organizations interested in promoting a general plan of ornamental street lighting, have secured the co-operation of the city authorities and of the Union Gas & Electric Company, the company making an offer to install a comprehensive system for $150,000 more than the present street-lighting system in the business district costs, over a six-year period. Reports on the proposal are encouraging. The electric company will install and furnish lighting for the system if the proposition is accepted.

COLUMBUS, O.—First announcement has been made by the Columbus Railway, Light & Power Company of its intention to build a new $375,000 power plant. The site is property already owned near the Scioto River, and permission of council is asked to strengthen the levee as a part of the city's general flood-prevention plans. The company has asked for speedy approval, stating that it wishes to begin work at once to care for its rapidly increasing business. It is understood that one of the company's several power houses, the original Edison plant, is to be abandoned.

DAYTON, O.—The Cincinnati, Hamilton & Dayton Railway Company is making plans for a new electric power plant in connection with the rehabilitation of its roundhouse in the East End.

HAMILTON, O.—The city is considering plans to modernize and extend its fire-alarm system, which is at present inadequate. A complete new system may be installed, or a proposal from the Gamewell Fire Alarm Company to remodel the present system, at a cost of $2,500, may be accepted.

SIDNEY, O.—Plans are being considered for the installation of a municipal electric-lighting plant here.

SPRINGFIELD, O.—The city's engineering department has prepared drawings and specifications setting forth the style of lamps which has been decided upon for the ornamental street-lighting system and these will be sent to various lamp manufacturers to bid upon. The contract will be awarded early in May, it is announced.

ULRICHVILLE, O.—A committee has been appointed to secure estimates for a municipal electric-lighting plant.

YOUNGSTOWN, O.—The Youngstown & Niles Railway Company has asked the Public Utilities Commission for authority to issue $100,000 capital stock to secure funds with which to build a line from Youngstown to Warren.

ELKHART, IND.—J. B. Davidson, president of the Board of Works, following a conference with officials of the Indiana & Michigan Electric Company, has announced that work on the installing of a new lighting system on Main Street will begin in 30 days.

RICHMOND, IND.—Alfred Bavis, president of the Board of Works, has announced that favorable action will be taken on the petition for an ornamental lighting system on Main Street, and that bids will be called for soon. The improvement is estimated to cost $11,000.

WINCHESTER, IND.—The Citizen's Heat, Light & Power Company has signed a 15-year contract for lighting the city streets. Plans for a boulevard lighting system are being considered, and such a system probably will be installed.

BELLEVILLE, ILL.—The City Council has approved a plan for the raising of funds for a municipal electric-lighting plant to cost $350,000. The plan adopted was that of combining a special assessment and public certificate plan, the former to furnish $120,000 for the distribution system, and the latter to furnish $230,000 for the remainder of the plant. The certificates are to be sold with the municipal mortgage as plant security.

CARROLLTON, ILL.—Bonds have been authorized for the establishment of an electric-lighting system.

CHICAGO HEIGHTS, ILL.—The Chicago Heights Street Railway Company, C. H. Wacker, president, has asked for authority to extend its lines on certain streets.

PEORIA, ILL.—An ornamental lighting system, five lamps to a block, will be installed on Perry Avenue.

SOUTH PEORIA, ILL.—The Central Illinois Light Company, of Peoria, is considering plans for extending its lines to this place. A street-lighting system probably will be installed.

WATERMAN, ILL.—The Illinois Northern Utilities Company is preparing to furnish electric service here. The energy will be supplied from the company's plant at Paw Paw.

DEPERE, WIS.—The DePere Electric Light & Power Company is planning to remodel its plant to change the current output from direct to alternating. Plans have been prepared by H. A. Smith, consulting engineer, Madison, Wis., calling for an expenditure of $20,000. L. L. Tessler is superintendent of the plant.

MADISON, WIS.—J. E. Jones, president of the Wisconsin Interurban System which contemplates the construction of an interurban railway between Madison and Janesville, has made the announcement that his field force of surveyors were already at work on the proposed route.

MERTON, WIS.—The construction of a transmission line by the Milwaukee Light, Heat & Traction Company from Pewaukee to Merton and Lake Five is now under way, and service will be furnished in a few months.

SUPERIOR, WIS.—As a result of requests received from various sections of the city it is probable that the entire street-lighting system in the residence districts will be changed and new corner incandescent lights installed.

WAUKESHA, WIS.—The Waukesha Pure Food Company, O. E. Glidden, manager, will build a power plant in connection with a factory to be erected here.

ARGYLE, MINN.—The Council has appointed a committee, of which C. J. Robertson is a member, to secure estimates for building a water and electric-lighting plant.

BRAINERD, MINN.—The Brainerd Gas & Electric Company has been incorporated with $100,000 capital stock by St. Cloud capitalists, with Brainerd as its principal place of business and St. Cloud as its principal branch office. The incorporators are: A. G. Whitney, president; R. L. Gale, vice-president; A. J. Bemis, secretary, and P. H. Collignon, treasurer. Construction work will soon be under way. H. G. Williams will superintend the construction.

CARVER, MINN.—Plans are being considered for a white-way system here.

GILBERT, MINN.—J. M. Carlson, N. J. Colvin and L. Rubenstein, members of the Water and Light Commission of Gilbert, are on a trip to the eastern cities to inspect white-way systems and to make preparations for installing a lighting system in this city.

HIBBING, MINN.—Residents of Second Avenue and Center Street have petitioned the Water and Light Commission to install a new lighting system on those streets.

LITTLE FALLS, MINN—Construction work on an transmission line which will eventually supply energy for power and lighting to Long Prairie, Wadena, Verndale, Staples and intermediate towns will be begun by the Little Falls Water Power Company this spring. The line will be in the form of a loop, going from Little Falls west to Long Prairie, thence north to Wadena and southeast to Staples and Little Falls. At Long Prairie an electric pumping station and street-lighting system will be installed. Two of the towns which are to be supplied have already granted franchises.

MINNEAPOLIS, MINN.—President Brewer, of American Public Utilities Company, has announced that the Wisconsin-Minnesota Light & Power Company, a subsidiary, has closed a contract for the sale to the Northern States Power Company of 40,000 horsepower of electric energy from the plant now being constructed on the Chippewa River, and that a high-tension transmission line to carry this current to Minneapolis for distribution by the Minneapolis General Electric Company will be built at a cost of $700,000.

GUTTENBERG, IOWA.—The City Council has accepted the contract offered by Schmidt Brothers & Company, who own the electric-lighting plant at Elkader, for supplying electrical energy for power and light. The city will be bonded for $10,000 to install a distribution system.

DATES AHEAD.

Iowa Section, N. E. L. A. Annual meeting, Dubuque, Iowa, May 10-12. Secretary, W. H. Thomson, Jr., Des Moines, Iowa.

Missouri Association of Public Utilities. Annual convention, May 11-13, on board boat leaving St. Louis May 11. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

National District Heating Association. Annual convention, New York City, May 16-19. Secretary, D. L. Gaskill, Electric Building, Greenville, O.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 17-20. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Electric Light Association. Annual convention, Chicago, Ill., May 22-26. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

Gas, Electric and Street Railway Association of Oklahoma. Annual convention, Oklahoma City, Okla., May 23-25. Secretary, H. V. Bozell, Norman, Okla.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., June 6-8. Secretary, R. E. Fowles, Pine Bluff, Ark.

American Institute of Chemical Engineers. Semi-annual meeting, Cleveland, O., June 14-17. Secretary, J. C. Olsen, Cooper Union, New York City.

National Electrical Contractors' Association of the United States. Annual convention, Hotel McAlpin, New York City, July 18-22. Secretary, G. H. Duffield, 41 Martin Building, Utica, N. Y.

MARATHON, IOWA.—At a recent election the town of Marathon voted bonds in the sum of $12,000 to finance the establishment of an electric-lighting system and closed a contract with the Peterson Power & Milling Company for supplying electrical energy.

ROCK RAPIDS, IOWA.—The City Council has sold a $15,000 issue of water and electric-light bonds. Work will be started soon on remodeling and enlarging the electric light plant and also extending the water plant. The building is to be enlarged, new boilers, engine and dynamo installed and the plant brought up to date. A heating plant will also be installed.

SLATER, MO.—The city has voted $35,000 in bonds to provide for extensions to the water mains and improvements in the municipal electric-lighting plant. The city has made a contract with the Alton-Slater Water Company to furnish electrical energy for pumping 400,000 gallons of water daily for a period of 20 years. A 13,200-volt transmission line will be erected to this city from the new plant of the Alton-Slater Company eight miles east of here. L. E. Shepherd is superintendent of the Slater Light and Water Works and A. L. Nichols is superintendent of the Alton-Slater Water Company.

SPRINGFIELD, MO.—The city recently made a contract for five years with the Springfield Gas & Electric Company for the maintenance of 294 street lamps. The Council has authorized the erection of 61 additional lamps, eight being arcs and the rest 200-candlepower incandescents.

OTTAWA, KANS.—The City Commission has approved specifications for tests for new machinery which will govern the purchase of a new 350-kilowatt unit (or possiby two) for the city power plant, as prepared by George C. Shaad of Lawrence, Kans. Bids will be received up to May 15. The new equipment will consist of a new unit complete, with surface condenser and auxiliaries, spray cooling equipment and a complete new switchboard. David Flinchpaugh is commissioner of utilities, and W. O. Myers is superintendent of the plant.

KEARNEY, NEB.—The Kearney Water & Electric Power Company has been granted permission by the State Railway Commission to issue $200,000 in bonds.

OMAHA, NEB.—City Commissioner Jardine has announced tentative plans for the new street-lighting system to be installed here. The proposition, outlined by Mr. Jardine, contemplates a three-year contract with the Omaha Electric Light & Power Company, which will make an installation of over 1,000 new lamps.

TRENTON, NEB.—Bonds have been authorized for the erection of a municipal electric-lighting plant.

CLARK, S. D.—The City Council is considering plans for the installation of an electric-lighting plant in conjunction with the present municipal gas and waterworks plants.

DEADWOOD, S. D.—Announcement has been made by the Consolidated Power & Light Company that it had purchased the holdings of Sturgis (S. D.) Light & Power Company. The Consolidated now supplies electricity for lighting purposes to Lead, Deadwood, Spearfish, Belle Fourche and Whitewood.

JAVA, S. D.—Bonds have been voted for the erection of a municipal electric-lighting system here.

FOREST CITY, N. D.—The installation of an electric-lighting system costing about $10,000 is being considered by A. B. Field, I. W. Poole and others.

NEW ROCKFORD, N. D.—On May 7 citizens here will vote on the proposition of establishing a municipal electric-lighting plant.

TOWNER, N. D.—C. B. Rasness and J. E. Galehouse, of Carrington, are seeking a franchise giving them the right to install and operate an electric-lighting plant here.

SOUTH CENTRAL STATES.

CYNTHIANA, KY.—President Reed, of the Kentucky Utilities Company, City Agent Durbin and Commissioner of Public Works Wohlwender, are conferring on the matter of a renewed contract for street lighting. Lately the city officials were reported considering a municipal plant.

KUTTAWA, KY.—The Cumberland Electric Company has been incorporated with a capital of $3,500 by B. W. Doom, M. J. Beard and others to furnish electric service here.

LAGRANGE, KY.—J. W. Stoval, J. W. Lusby and others have organized a company which has taken over the present electric-lighting plant and which will make some improvements and continue to operate it. Since the franchise was sold for a lighting plant here to the Adams Utility Company, of Sulphur, it is understood that the purchaser has disposed of these rights to a company which proposes to establish a lighting and water plant.

LEBANON, KY.—The Lebanon Light, Ice & Power Company, is making improvements in its distribution system, including new poles, which are used by both the telephone and lighting companies.

PAINTSVILLE, KY.—Damage was done recently to the local lighting plant by an electric storm.

SARDIS, KY.—Albert Hill, of Maysville, Ky., has installed an electric-lighting plant in the Sardis opera house, which will be used for lighting the building. It is of sufficient capacity to provide service for the community.

STITHTON, KY.—The Stithton Lighting Company has sold its plant to L. J. Metcalfe and C. H. Aubrey.

DYERSBURG, TENN.—The city is planning to make extensive improvements to the municipal electric lighting plant.

FRIENDSHIP, TENN.—W. H. Fisher, manager of the local electric-lighting plant, announces that additional generating equipment will be installed and the extensions made to the distribution system. The city will install a street-lighting system.

BIRMINGHAM, ALA.—The steam plant of the Alabama Power Company will be located on the Warrior River, about two miles from the Drifton branch of the Southern Railway, according to an announcement made by James E. Mitchell, president of the company. He also announced that work will begin at once on the new transmission system and that a new power unit will be installed at Lock 12 on the Coosa River.

ITTA BENA, MISS.—The city has purchased the local electric-lighting plant from J. L. Haley for $14,250.

ARKADELPHIA, ARK.—It is reported that the Arkadelphia Light & Power Company has purchased the electric-lighting plant at DeQueen and will make extensive improvements there.

CHANDLER, OKLA.—The Chandler Electric Company, of which R. C. Johnston is president and G. D. Henderson is manager, has been granted a new franchise covering a period of 20 years. The company will make extensive repairs and install new generating equipment, furnishing 24-hour service.

COMMERCE, OKLA.—The Empire District Electric Company, Joplin, Mo., which holds franchises in many towns of the Miami mining district, will pay the expenses of an election to be held here on the question of granting the company an electric-lighting franchise.

DURANT, OKLA.—Stockholders of the [illegible] Ice & Light Company have sold their interests to William A. Baehr and associates, of Chicago, Ill. Mr. Baehr is president of the newly organized concern; D. S. McDonald, Durant, vice-president; A. H. Brown, Chicago, treasurer, and W. J. O'Brien, secretary. The controlling interests, it is understood, will purchase several similar properties in Southern Oklahoma.

KUSA, OKLA.—A charter has been granted to the Kusa Ice, Light & Power Company, capitalized at $25,000. The incorporators are: D. F. Servey, Iola, Kans.; R. C. Clark, Kansas City, Mo., and J. G. Goshorn, Henryetta, Okla.

NEW WILSON, OKLA.—The city will issue $25.000 in bonds for installation of an electric-lighting plant and water works.

RINGLING, OKLA.—Power secured by utilizing the Washita River in Southern Oklahoma may operate the Oklahoma, New Mexico & Pacific Railroad, otherwise known as the Ringling road, if plans now on foot are consummated. It is proposed also to build transmission lines to Waurika and points in the Healdton oil fields north of Ringling. The proposed power site probably would be in the Arbuckle Mountains.

BALLINGER, TEX.—The Council is contemplating the purchase of the local electric-lighting plant.

COMANCHE, TEX.—The Texas Power & Light Company, of Dallas, has purchased the Comanche Light & Power Company's plant and will erect a high-tension transmission line for connection with the former company's generating station in Brownwood, Tex.

FLOYDADA, TEX.—The City Council has granted a 50-year franchise to the Texas Utility & Power Company for an electric power plant, same to be 24-hour service and not less than $8,000 to be expended in wiring the town. Construction is to begin within 90 days.

GONZALES, TEX.—Field notes for the San Antonio, Gonzales & Houston Interurban Railroad have been completed. Messrs. Kennedy and Godman are promoters of the road.

STOCKDALE, TEX.—G. A. Burrie has purchased a system of poles, already installed in Stockdale, with a view to installing an electric-lighting plant here in the near future.

WACO, TEX.—The capacity of the power plant of the Texas Power & Light Company, located in this city, will soon be doubled. A contract has been awarded for the installation of four additional boilers. This plant supplies light and power for Waco and all small towns in Central Texas, and the interurban road between Waco and Dallas. The additional facilities will be sufficient to operate the proposed extension of the interurban to Temple and Austin.

WESTERN STATES.

BUTTE, MONT.—According to official reports from the Montana Power Company, the work of completing the hydroelectric development at Holter is being rushed and actual completion is expected by August, 1917. The proposed plant will have a capacity of 40,000 horsepower. It is reported the Montana Power Company has plans under way for the construction of another large power plant in Montana to supply the increasing demand for energy made by the various railroad and mining companies in the state.

PHILIPSBURG, MONT. — The Bowen Brothers Electric Light & Power Company has incorporated with a capital of $40,000 by Fred Bowen, Jr., Walter Carter and others. The company furnishes electric service here and recently closed a two-year contract for city street lighting.

ALAMOGORDO, N. M.—The city has taken over the plant and distributing systems of the Alamogordo Light & Power Company for $25,000.

LAS CRUCES, N. M.—The board of directors of the Water Users' Association has investigated the Leasbury hydroelectric power proposition and estimates that the cost of construction, installation of machinery and power line to Las Cruces will be $60,000.

LAS VEGAS, N. M.—The Rio Grande Light, Heat & Power Company has filed with the state engineer the estimated cost of the proposed hydroelectric development at the mouth of White Rock Canyon. The ultimate installation is to be 25,000 horsepower, but the immediate installation is to be only 10,500 horsepower, necessitating a dam 60 feet lower than was at first figured. The cost of the dam is figured at $772,690. Intakes and penstocks are to cost $127,310; powerhouse, $66,000; machinery, $322,800; transmission lines, $271,000; substations, $180,000, together with incidentals, interest, etc., requiring an ultimate outlay of $2,221,157. The initial expenditure is to be $1,639,614.

ALBION, IDAHO.—Materials have been ordered by the City Council for the installation of an electric-lighting system. The heating of the Albion Normal School with electricity is under contemplation by the school board.

LEWISTON, IDAHO. — The Lewiston-Clarkston Transit Company, according to recent reports, will immediately begin the expenditure of approximately $25,000 in extending lines of the local street-car system.

LEWISTON, IDAHO.—A recommendation for the construction of a large hydroelectric plant to be constructed with the assistance of several nearby municipalities has been made by Major J. E. Hoobler. It is reported the City Council and the local commercial organizations favor construction of the plant.

EVERETT, WASH.—Robert Howes, consulting engineer, American Bank Building, Seattle, has been commissioned by the City Council of Everett to gather data on power possibilities in the Sultan Basin, looking forward to the development of a municipal power project.

LIND, WASH.—Superintendent J. D. Lewis, of the Washington Water Power Company, Spokane, reports his company will extend electric service to the experimental farm near Lind, and possibly to adjoining farms. Construction, it is reported, will begin sometime in May. The experimental farm will be equipped with electric lights, two electric ranges, churns, cream separators, and other equipment, all of which will be operated by electricity.

MONTESANO, WASH.—It has been definitely established that the Northwestern Electric & Water Works has purchased the holdings of the Elma (Wash.) Light & Power Company, and that the two plants will be operated in conjunction. Manager R. J. Andrus, of the Northwestern company, reports the purchase will result in reduction of rates to Elma patrons of about 12 per cent, and will give Elma facilities for obtaining power for manufacturing purposes. He also reports extensions to rural residents between Elma and Montesano will be made and the town of Satsop will be given electric service. According to present plans, the Elma plant will be managed by Mr. Andrus, and the Montesano plant by D. L. Plantz.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has petitioned the Board of County Commissioners, Yakima County, for permission to erect transmission lines and make extensions to its lines in the vicinity of Sunnyside.

SEATTLE, WASH—City Engineer A. H. Dimock, Councilman R. H. Thomson, and J. D. Ross, Superintendent of Lighting, will immediately inspect the Sauk-Suiattle Power project where the city of Seattle contemplates the development of additional current for use of the municipal lighting department. According to reports, the Department of Agriculture, Washington, D. C., has requested the city to come to some decision as regards the development of the project, which has been selected by the American Nitrogen Company, who purposes the contruction of a nitrogen plant and the ultimate investment of $30,000,000 in the development of the site.

SPOKANE, WASH. — Negotiations will probably be closed soon for the purchase of the electric power plant of the Similkameen Power Company by Eugene Enloe, of Spokane, representing the Okanogen Valley Power Company, according to a report from Oroville. The Okanogan Valley Power Company has a plant on the Methow River that provides service for Pateros, Brewster, Bridgeport, Okanogen and Riverside. The Similkameen Power Company was organized 12 years ago by the late J. M. Haggerty and possesses valuable undeveloped waterpower sites.

WENATCHEE, WASH.—A contract has been negotiated between the city and the Wenatchee Valley Gas & Electric Company whereby the latter will furnish current for lights for public buildings, parks and city streets for a term of five years beginning May 1. The Wenatchee company heretofore held a contract for this service.

GRANTS PASS, ORE.—William H. Swalwell, manager of the Everett Paper Mill Company at Everett, Wash., and a stockholder in the Black Eagle group of mining claims in the Kirby District, reports a hydroelectric plant for supplying energy for light and power will be installed at the mines.

PORTLAND, ORE.—Details for providing Portland with a municipal lighting system, sufficient to light all the streets and public buildings of the city, are being worked out by engineers of the Municipal Water Bureau under the direction of Commissioner W. H. Daly of the Department of Public Utilities.

RIDDLE, ORE.—The construction of a 250-horsepower power plant in this city is being promoted by A. E. Brais to supply this city with electrical energy for light and power.

BERKELEY, CAL.—Property owners have asked the Council to form a lighting district east of Shattuck Avenue and north of the University of California campus.

LAKEPORT, CAL.—F L. Wright, general manager of the California Telephone & Light Company, has been looking over the Lake County plant with a view to its reconstruction.

LOS ANGELES, CAL.—The Board of Supervisors has granted the request for additional lights in the Hawthorne Lighting District.

LOS BANOS, CAL.—A movement is on foot here which will probably result in the installation of a new electrolier lighting system.

OAKLAND, CAL.—A movement has been started looking toward the installation of a new lighting system on Lincoln Highway.

REDDING, CAL.—At a recent election it was decided to have the city construct an electric-lighting system.

SANTA ANA, CAL.—The City Trustees are considering ways and means for better street lighting.

SAN FRANCISCO, CAL.—The Great Western Power Company and the Pacific Gas & Electric Company have arranged for the joint use of poles on Clement Street from Arguello Boulevard to Twenty-fifth Avenue, thus obviating the hearing by the Board of Works of a protest from the Richmond district of the number of poles on that street. The Great Western Power Company is to erect poles 60 feet high, large enough to carry the wires of several companies, and will transfer to them the wires of the Pacific Gas & Electric Company, which will then remove its small poles.

SANTA ROSA, CAL.—Plans for an ornamental street-lighting system will shortly be presented to the City Council.

SOUTH SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has been awarded a contract for the installation of a new lighting system in this city.

VENTURA, CAL.—Application has been made by the Ventura County Power Company for a franchise to extend its electric transmission lines in certain parts of the county. Bids will be received up to May 10.

NOME, ALASKA.—Bonds were voted at a recent election for the installation of a municipal lighting plant.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	April 24	April 17
American Tel. & Tel. (New York)	127½	128
Commonwealth Edison (Chicago)	141	141
Edison Electric Illuminating (Boston)	235	236
Electric Storage Battery common (Philadelphia)	.....	.....
Electric Storage Battery preferred (Philadelphia)	.....	.....
General Electric (New York)	162¼	165
Kings County Electric (New York) (ex-dividend)	128½	130
Massachusetts Electric common (Boston)	6¾	6¾
Massachusetts Electric preferred (Boston)	34½	35
National Carbon common (Chicago)	.....	.....
National Carbon preferred (Chicago)	.....	.....
New England Telephone (Boston)	133	134½
Philadelphia Electric (Philadelphia)	28	28
Postal Telegraph & Cables common (New York)	78	78
Postal Telegraph & Cables preferred (New York)	67½	68
Western Union (New York)	89¾	90
Westinghouse common (New York)	57¾	62½
Westinghouse preferred (New York)	70	70

Financial Notes

Alabama Power Company, operating subsidiary of Alabama Traction, Light & Power Company, has called for payment August 1 at 101, through the United States Mortgage & Trust Company, New York City, the $2,000,000 first-mortgage six-per-cent bonds due February 1, 1918. For the retirement of these bonds a part of the funds secured by the recent sale of $4,000,000 first and refunding five-per-cent bonds will be used.

Mahoning & Shenango Railway & Light Company, operating subsidiary of Republic Railway & Light Company, has filed in the counties in Ohio and Pennsylvania in which its properties are located, a mortgage securing $10,000,000 refunding and improvement bonds. The mortgage, which covers all property of the company, is given to the Guaranty Trust Company, of New York, as trustee, and the bonds are to be retired in equal blocks annually during the next 100 years.

Dividends.

	Term	Rate	Payable
Bangor Ry. & Elec.	Q	0. 5%	May 1
Pow., com.	Q	1 %	May 1
Conn. Ry & Lt., pf.	Q	1 %	May 15
Conn. Ry. & Lt., pf.	Q	1 %	Aug. 15
Conn. Ry. & Lt., pf.	Q	1 %	Nov. 15
Houghton Co. Elec., pf.	S	3 %	May 1
Houghton Co. Elec., com.	S	2.5 %	May 1
Kaministquia Pw.	Q	1.5 %	May 15
Montreal Lt., Ht. & Pw.	Q	2.5 %	May 15
Montreal Tramways	Q	2.5 %	May 1
North American	Q	1.25%	July 1
Pacific Pw. & Lt., pf.	Q	1.75%	May 1
Texas Pw. & Lt., pf.	Q	1.75%	May 1

Reports of Earnings.

NEW YORK EDISON.

The Public Service Commission has issued a report covering the operations of the New York Edison Company for the year ended December 31, 1915, which compares as follows:

	1915	1914
Operating revenues	$22,546,068	$23,538,342
Operating expenses	9,649,679	9,932,976
Net operating revenue	12,896,390	13,605,366
Taxes	1,469,369	1,361,624
Uncollectible bills	88,152	101,767
Rentals	1,521,615	1,502,306
Reserves	2,861,999	3,483,056
Net profits	6,955,255	7,156,614
Interest	556,521	915,734
Dividends	4,451,855	3,720,204
Surplus after dividends	1,946,789	2,520,676
Other additions	143,400	*44,037
Previous surplus	32,091,343	29,614,704
Profit and loss surplus	34,181,622	32,091,343

*Deduction.

KINGS COUNTY ELECTRIC LIGHT & POWER.

The combined statement of the Kings County Electric Light & Power Company and Edison Electric Illuminating Company of Brooklyn for the quarter ended March 31, 1916, compares as follows:

	1916	1915
Gross	$2,136,019	$1,754,248
Net after taxes and depreciation	690,849	643,668
Other income	15,714	11,715
Total income	706,563	655,383
Surplus after charges	498,690	438,595

GENERAL ELECTRIC COMPANY.

The General Electric Company has issued its annual report for the year ended December 31, 1915. The income account compares as follows:

	1915	1914
Sales billed	$85,522,070	$90,467,692
Costs, incl. op. maint. depr. chgs.	76,898,183	$1,496,728
Profit	8,623,887	8,970,963
Int. and sundry rev.	2,129,266	1,570,431
Inc. fr. sec.	1,554,843	1,313,989
Total inc.	12,307,996	11,855,383
Debent. int.	570,086	567,556
Net profit	11,737,910	11,287,827
Dividends	8,129,919	8,142,867
Surplus	3,607,992	3,145,060
Balance	3,607,992	3,145,060
Prev. surp.	20,084,879	16,939,819
P. & L. surp.	23,692,871	20,084,879

The net profit was equal to 11.56 per cent earned on $101,510,600 capital stock, against 11.12 per cent earned on $101,485,700 stock in 1914.

In his remarks to stockholders, Chairman C. H. Coffin said in part: Value of orders received by the company for electrical apparatus and devices in the past year was $98,385,891, an increase of $14,637,370, or 17 per cent over those of 1914. This increase was largely due to the general revival of business in the latter part of the year. These figures are exclusive of orders for special war munitions, which amounted to $33,980,000 during 1915. These have been so restricted as to interfere as little as possible with the regular product of the company. The percentage of profit from these orders will probably be less than that of the average of the company's output. The amount of sales billed was $85,522,070, a decrease of $4,945,621, or 6 per cent.

Number of employes engaged in the factories and offices, and in those of subsidiary companies at the end of 1915, was about 60,000.

The company has followed its customary practice in writing off against income account its total expenditures in 1915 for patents, applications for and licenses under patents, and other outlays relating thereto, amounting to $838,455. The patent account is carried at $1, as in previous years. Stocks, bonds, and other securities are carried at a valuation of $32,916,593, of which $19,687,965 represents securities of subsidiary companies, and $13,228,628 those of public utility and other companies. Current accounts and notes receivable are carried at $19,619,215.

Sales of several small factories substantially offset the manufacturing floor space added in 1915; and plant expenditures amounting to $4,485,068 were chiefly for improvements in existing construction and equipment, and the purchase of special tools and machinery which are subject to a high rate of depreciation. Because of the nature of these expenditures, and on account of the liquidation of the book value of the factories sold, the reduction in the plant account for the year was $5,985,068.

The company has no note payable, nor is there any paper outstanding bearing its endorsement.

At a meeting of directors, on February 11, George E. Emmons, who has held important positions in this company and its predecessor since 1886, was elected vice-president.

Proposals

ELECTRICAL WORK.—Sealed proposals will be received until noon of May 22, by George W. Fricke, clerk of the Board of Education, Reading, O., on the electrical and other work involved in the completion of the Reading school. Garber & Woodward, Cincinnati, O., are the architects.

ELECTRICAL WORK.—Sealed bids will be received until May 4, at Room 406, City Hall, Chicago, Ill., for furnishing all labor and material and for installing all electrical work required in the 16 one-story office buildings, shelters, and sand-court buildings at various school sites, according to plans on file in the office of the Department of Public Works. W. R. Moorhouse, Commissioner of Public Works.

POWER PLANT.—Sealed proposals will be received by the Board of Administration, in its office in the Capitol Building, Springfield, Ill., May 16, for power plant, piping and accessories to be installed in the new power house at the Alton State Hospital, near Upper Alton, Ill. Plans may be obtained upon application to Martin C. Schwab, consulting engineer, 1514, Mallers Building, Chicago, Ill. Frank D. Whipp, Fiscal Supervisor of the Board of Administration, Springfield, Ill.

New Incorporations

LOGANSPORT, IND.—Rutenber Electric Company has increased its capital from $85,000 to $200,000.

MILWAUKEE, WIS.—The Bureau of Electric Sign Engineering. Capital, $10,000. Incorporators: J. B. Lindl, Joseph Lindl and W. O. Meilahn.

CANFIELD, O.—Canfield Gas & Electric Company. Capital, $100,000. Incorporators: W. J. Smith, John Rowan, A. Wiesner, C. C. Neff and C. R. Wetmore.

SAN FRANCISCO, CAL.—The Electric Sales Service. Capital, $100,000. Incorporators: W. W. Briggs, H. E. Kennedy, H. A. Mulvay, W. S. Leffler and W. S. Braun.

BRONX, N. Y.—Interstate Switchboard & Supply Company. Capitol, $11,000. Incorporators: A. E. Reinhardt, 1341 Franklin Avenue, Bronx; G. N. Reinhardt, Bronx, and C. Millikow, New York City.

NEW YORK, N. Y.—Marko Storage Battery Depot of New York. Capital, $5,000. Incorporators: P. M. Marko, 142 Norwood Ave., M. H. Tuttle, and J. Kresse, Brooklyn.

BUFFALO, N. Y.—The Battery & Starter Company. Capital $10,000. Manufacture electric accessories for automobiles, batteries, etc. Incorporators: E. F. Miller, W. R. Devine and J. B. Rodgers, all of Buffalo.

POTSDAM, N Y.—St. Lawrence Transmission Company. Capital, $525,000. Formed by the consolidation of the St. Lawrence Transmission Company and the Northern Power Company, to generate and deal in electricity. Incorporators: G. R. Gibbons, Pittsburgh; F. A. Stoughton and Paul B. Murphy, Potsdam.

Electrical Patents Issued April 18, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,179,389. Circuit-Controlling Device. J. T. Austin, assignor to Austin Organ Co., Hartford, Conn. For electromagnetic organ.

1,179,395. Insulating Support for Storage-Battery Tanks. H. M. Beck, Evanston, Ill. Stands in cup of insulating fluid which it protects with petticoat.

1,179,407. Electrical Truck. F. J. Decker, assignor to Shafer-Decker Co., Rochester, N. Y. Motor mounting and gearing.

1,179,414. Process of Thickening Oils. C. Ellis, Montclair, N. J. Fatty oil subjected to ultra-violet rays in absence of oxygen.

1,179,428. Screen. E. Hayes, Park City, Utah. For sifting; electromagnetically vibrated.

1,179,478. Electric-Braking System. P. S. Turner, assignor to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Motor disconnected from supply and connected to braking circuit on backward movement of vehicle.

1,179,486. Water-Level Recorder. J. M. Wight, Lakewood, O. Float-controlled device for boilers.

1,179,495. Transforming Battery. A. Burkhardt, New York, N. Y. Interconnection of cells having zinc and aluminum electrodes.

1,179,498. Combined Terminal Box and Switch Support. C. H. Bissell, assignor to Crouse-Hinds Co., Syracuse, N. Y. Switch parts carried by separable box sections and locked open when box sections are not locked together.

1,179,502. Battery and Lamp Tester. W. F. Cass, Escanaba, Mich., assignor of one-half to L. N. Schemmel, Escanaba, Mich. Unitary device for application to terminals of batteries, etc.

1,179,512. Time-Controlled Electric Switch. L. T. Fenning, Jackson, O. Clockwork mechanism.

1,179,515. Alternating-Current Rectifier. L. E. France, Cleveland, O. Magnetic vibratory device for charging batteries.

1,179,517. Telegraph Instrument. E. L. Gilleland, Grand Forks, N. D. Details of sounder.

1,179,522. Process of Extracting Metals From Their Ores. W. E. Greenawalt, Denver, Col. Electrolytic treatment.

1,179,530. Direct-Acting-Solenoid Resistance Regulator for Train-Lighting Systems. P. Kennedy, Brooklyn, N. Y. Contact structure and operation.

1,179,537. Electrically Controlled Valve. L. A. Mapel, assignor to Mapel Mfg. Co., St. Louis, Mo. Closing mechanism released by float-controlled solenoid.

1,179,540. Electric Valve-Controlling Mechanism. L. A. Mapel, assignor to Mapel Mfg. Co. Modification of above.

1,179,624. Overload Indicator. C. F. Gilliatt, assignor to The Excess Indicator Co., Pittsburgh, Pa. Details of electromagnetically operated contact device.

1,179,637. Circuit Controller. C. J. Kruse, assignor to Cutler Hammer Mfg. Co., Milwaukee, Wis. Polyphase motor controller responsive to circuit conditions.

1,179,642. Telephone Attachment. J. F. Makowski, assignor to Telephone Appliance Co., San Francisco, Cal. Receiver support for clamping to desk instrument.

1,179,648. Meter Seal. C. C. Personette, St. Louis, Mo. Details of device secured by frangible stud.

1,179,700. Take-Up Device for Telephone

Cords. W. P. Cornell, Charleston, S. C. Spiral spring extending along and secured to cord.

1,179,722. Lightning Arrester. W. J. Heinritz, Norristown, Pa. Electromagnet in series with horn gap in ground connection draws horns apart. (See cut.)

1,179,728. Separable Attachment Plug. G. P. Knapp, assignor to Harvey Hubbell, Inc., Bridgeport, Conn. For connecting chafing dishes and the like; has provision for ground wire.

1,179,741. Automatic Telephone System. G. E. Mueller, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Arrangement and construction of selective switches.

1,179,761. Watch. J. Rosemont and F. Amati, Trenton, N. J. Has battery lamp to illuminate dial controlled from stem.

1,179,769. Street-Indicating Mechanism. T. W. Small, assignor to Acme Indicator Co., Cleveland, O. Drum device operated by spring motor and controlled by magnetic clutches.

1,179,770. Street-Indicating Apparatus. T. W. Small, assignor to Acme Indicator Co. Strip intermittently fed by solenoid.

1,179,779. Starting and Lighting System. H. W. Uhl, Freeport, N. Y. Dynamo for operating from automobile engine has armature and field rotatable with braking means for one regulated according to speed of engine.

1,179,783. Bond-Wire Protector. E. W. Vogel, assignor to Chicago Railway Signal & Supply Co., Carpentersville, Ill. Hook encloses wire and is secured to splice bar by plug.

1,179,805. Electric Regulation. J. L. Creveling, assignor to Safety Car Heating & Lighting Co., Jersey City, N. J. Voltage regulation of battery and dynamo car-lighting system.

1,179,878. Trolley Retriever. F. A. Wasson, Milwaukee, Wis. Details of pressure fluid-operated trolley-swinging motor.

1,179,891. Electric Switch. T. Bozzetti, assignor to Maricanola & Testa, Turin, Italy. Pendant switch actuated by pressure or pull.

1,179,896. Telephone-Receiver Support. C. S. Cate, Easthampton, Mass. Details of vertical-turning spring-actuated arm.

1,179,903. Electric Battery. F. S. B. De Mello, Rio de Janeiro, Brazil. Depolarizer comprising artificial proto-sulfid of copper in a container.

1,179,906. Electric Signaling. R. A. Fessenden, assignor to S. M. Kinter, Pittsburgh, Pa., and H. M. Barrett, Bloomfield, N. J. Receiver for wireless telegraphy.

1,179,927. Device for Producing Oxids of Nitrogen. J. S. Island, Ontario, Canada. Arrangement of rotary and hollow electrodes producing electric flame for treatment of oxy-nitrogen gas.

1,179,929. Device for Breaking Circuit Between Generator or Magneto and Storage Battery. S. F. Johnson, Indianapolis, Ind. Ball governor lifts brush off commutator.

1,179,933. Electric-Circuit-Controlling Mechanism. S. Q. Kline, Jr., Washington, D. C. Float-operated mechanism.

1,179,936. Electrostatic Apparatus for Separating and Cleaning Grits, Grain, or the Like. J. Kraus, Brunswick, Germany. Electrodes form attractive and repelling poles and stripping off devices co-operate with stationary dielectric covering attractive pole.

1,179,937. Method of and Apparatus for Separating and Cleaning Materials in an Electrostatic Field. J. Kraus, Brunswick, Germany. Alternate fields and neutral zones travel along dielectric septum and particles attracted to field zones are removed.

1,179,957. Switch Mechanism for Controlling Circuits or High-Current Value. G. E. Palmer, assignor to Palmer Electric & Mfg. Co., Boston, Mass. Electromagnetically controlled switch in working circuit controlled by circuit supplied by auxiliary source of potential.

1,179,970. Side Connection for Electrical Cables. J. C. Stearns, Worcester, Mass. Special plug connector for armored or insulated conductors.

1,179,986. Electrical Cooking Utensil. A. A. Warner, assignor to Landers, Frary & Clark, New Britain, Conn. Mounting of heater element with special provision for its expansion and insulation. (See cut.)

1,179,987. Signal System for Railway Crossings. E. M. Weaver, Ozone Park, N. Y. Time electromagnetic mechanism for operating bell.

1,180,025. Process of Making Thickened Oil Product. C. Ellis, Montclair, N. J. Fatty oils subjected to ultra-violet rays in non-oxidizing atmosphere.

1,180,039. Electric-Generator Regulator. H. Hill and O. B. Dyer, Anderson, Ind. Generator field resistance has cam-operated short-circuiting contactor controlled by differential current and potential coils.

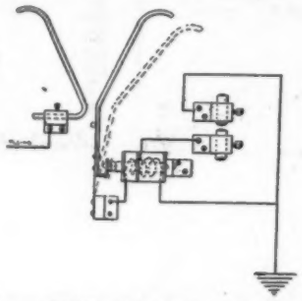
1,180,044. System of Electrical Distribution. M. H. Johnson, Utica, N. Y. Interlocking switches for controlling automobile-lighting circuits.

1,180,047 and 1,180,048. Electric Riveting Apparatus. F. P. Kobert, assignor to International Electric Riveter Co., Boston, Mass. First patent: Machine has plunger for forming current and swinging electrode arms for passing heating current through rivet. Second patent: Modification.

1,180,055. Rail Joint. S. Leschziner, Newark, N. J. Device for electrically connecting rail ends.

1,180,066. Process of Making Filaments. R. E. Myers assignor to Westinghouse Lamp Co., E. Pittsburgh, Pa. Making fine ductile filaments from refractory conducting material.

1,180,075. Production and Detection of Electric Oscillations. P. Pichon, assignor to Gesellschaft fur Drahtlose Telegraphie, M.



No. 1,179,722.—Lightning Arrester.

B. H., Berlin, Germany. Testing apparatus for producing and detecting oscillations of frequency in wireless telegraphy and telephony.

1,180,090. Electrolytic Device for Use in Electric Meters and Other Apparatus. W. B. Thorpe, Wandsworth Common, London, England. Comprises cell having two separate regions containing electrolyte with gas-trapping connection between.

1,180,096. Apparatus for Electric Welding. H. R. Woodrow and T. E. Murray, New York, N. Y. Relates to the clamping mechanism of a butt welder.

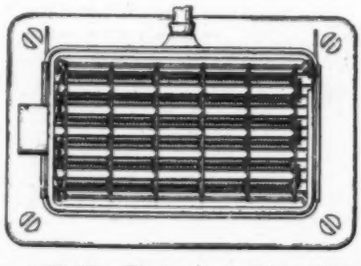
1,180,103. Apparatus for Controlling Electrical Circuits. R. E. Baker, assignor to A. G. McKee, Cleveland, O. Details of contacts operated by pointer of indicator.

1,180,138. Illuminated Sign. R. S. Giese, Pittsburgh, Pa. Structure of globe for porches, etc.

1,180,139. Combined Cylinder and Shade Support. R. S. Giese, Pittsburgh, Pa. Lamp enclosing cylinder for attachment to fixture supports upwardly opening bowl at its lower end.

1,180,144. Electric Warp Stop-Motion. J. Hancq, Jamestown, N. Y. Controlling contacts operated by heddle frame.

1,180,147. Combination Telephone. R. D. Hatch, Memphis, Tenn. Arrangement of re-



No. 1,179,986.—Electrical Cooking Utensil.

ceiver horn and transmitter in a hood for the face of the user.

1,180,158. Automatic Train Stop. J. A. Lanigan, Jr., Brooklyn, N. Y. Stop mechanism operated by cable drum on train when armature secured to cable end is arrested by track magnet.

1,180,159. Incandescent Electric Lamp. I. Langmuir, assignor to General Electric Co., Schenectady, N. Y. Tungsten lamp is filled with nitrogen at pressure of 300 millimeters of mercury or more.

1,180,173. Rail Joint. W. Montgomery and C. A. Kohler, Harrisburg, Pa. Manner of insulation.

1,180,174. Refrigerator Alarm. W. I. Moon and D. Hackmann, Baltimore, Md. Circuit controlled by drip-pan float.

1,180,184. Voting Machine. J. F. Price, Nashville, Ark. Has key-controlled electromagnetically operated type bars.

1,180,208. Electric Switch. G. B. Thomas and E. Anderson, assignors to the Bryant Electric Co., Bridgeport, Conn. Rotary, snap switch.

1,180,216. Float-Operated Circuit-Closer. L. L. White, Spokane, Wash. For oil reservoir.

1,180,218. Signal and Stopping Mechanism for Railway Cars. F. C. Williams, assignor to Safety Block Signal Co., Delaware. Semaphore mechanism.

1,180,236. Coin-Control Mechanism. C. F. Burkhardt, assignor to Burkhardt Automatic Shoe Polishing Machine Co., Buffalo, N. Y. Coin closes controlling-motor circuit of machine.

1,180,246. Vault and Safe Construction. N. B. Cregier, assignor to Vault Protection Co., Los Angeles, Cal. Alarm circuit controlled by vacuum pipe in walls.

1,180,264. Incandescent Body for Electric Lamps. A. Lederer, Vienna, Austria, Hungary. Consists mainly of tungsten which resists offsetting.

Reissue 14,113. Spark-Coil. C. H. Thordarson, Chicago, Ill. Original No. 958,899, dated May 24, 1910. Structure of core.

PATENTS EXPIRED.

The following United States electrical patents expired on April 25, 1916:

623,511. Automatic Electric Circuit-Breaker. M. Bouchet, Paris, France.

623,521 to 623,525. Electric Meter. T. Duncan, Fort Wayne, Ind.

623,526. Phase Adjustment. T. Duncan, Fort Wayne, Ind.

623,527 and 623,528. Electric Meter. T. Duncan, Fort Wayne, Ind.

623,529 and 623,530. Electric Motor. T. Duncan, Fort Wayne, Ind.

623,531. Multiple-Rate Electric Meter. T. Duncan, Fort Wayne, Ind.

623,532. Electric Meter. T. Duncan, Fort Wayne, Ind.

623,547. Ampere-Hour Electric Meter. G. Hummel, Munich, Germany.

623,570. Terminal Head for Electrical Conductors. C. H. Sewall, Chicago, and H. E. Procunier, Oak Park, Ill.

623,579. Differential Electromagnet. J. S. Stone, Boston, Mass.

623,583. Telephone Trunk Circuit. T. C. Wales, Jr., N. and H. M. Crane, Boston, Mass.

623,607. Electric-Lighting System. R. O. Hood, Danvers, Mass.

623,610. Electric Third-Rail System. L. M. Maxham, Boston, Mass.

623,611. Combined Listening and Ringing Key for Telephone Switchboards. W. O. Meissner, Chicago, Ill.

623,622. Electric-Motor Regulation. O. H. Pieper and A. F. Pieper, Rochester, N. Y.

623,623. Incandescent-Lamp Base and Socket. A. C. M. Prucker, Hanover, Germany.

623,625. Electric Brake. C. P. Pushaw, Washington, D. C.

623,637. Ship's Telegraph for Transmitting Signals, Orders, Etc. L. S. Thompson, Washington, D. C.

623,656. Portable Electric Lamp. A. Drescher, New York, N. Y.

623,659. Electric Belt. W. H. I. Geiger, Denver, Colo.

623,672. Railway Signal. J. Jorgenson, San Francisco, Cal.

623,678. Trolley Wheel. C. B. Lebcher, Miles City, Mont.

623,689. Pneumatic Electric Safe or Vault Protection. F. C. Smith, Delaware, O.

623,691. Process of and Apparatus for Manufacturing Alkali Metals. C. E. Acker, East Orange, N. J.

623,692. Process of and Apparatus for Manufacturing Metallic Alloys. C. E. Acker, East Orange, N. J.

623,702. Telephone Transmitter. P. C. Burns, Chicago, Ill.

623,717. Distributing Terminal. R. C. Donaldson, Pittsburgh, Pa.

623,730. Electric Incandescent Tube. W. J. McCutcheon, Pittsburgh, Pa.

623,778. Electric Igniter for Explosive Engines. J. H. Frew, Newcastle, Pa.

623,801. Combined Electric Arc-Lamp and Fan. J. Meizer, Cleveland, O.

623,811. Electric Glow Light. W. Nernst, Gottingen, Germany.

623,820. Electrically Propelled Road Vehicle. O. Patin, Puteaux, France.

623,821. Electrically Controlled Valve Gear for Gas or Other Motors. D. W. Payne, Elmira, N. Y.

623,846. Printing Telegraph. D. C. Smyth, Hartford, Conn.

623,887. Mechanical and Magnetic Amusement Game. H. Cottrell, Newark, N. J.

623,888. Electrodeposition of Zinc upon Iron. S. O. Cowper-Coles, London, England.

623,906. Electric Actuating Mechanism for Station Indicators. A. Hunter, San Francisco and C. Gustafson, Oakland, Cal.

623,908. Telephone Transmitter. E. H. Johnson, Omaha, Neb.

623,953. Electric Belt. W. P. Freeman, New York, N. Y.